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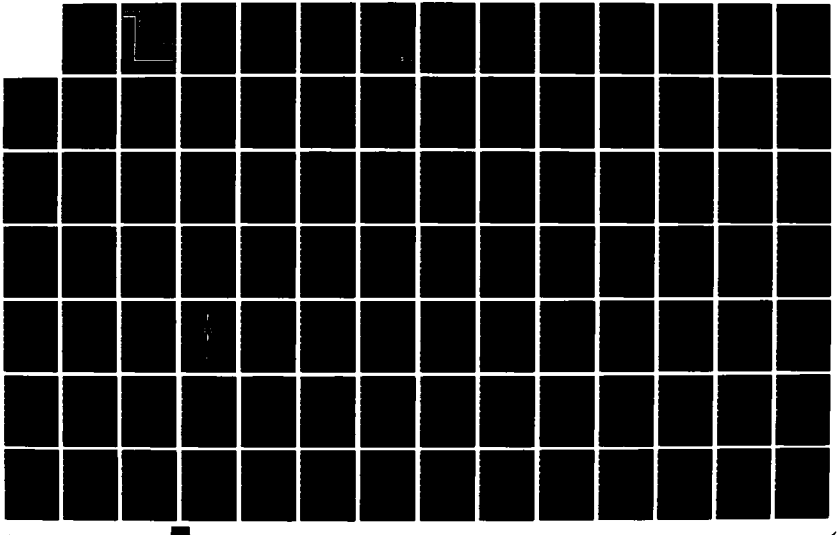

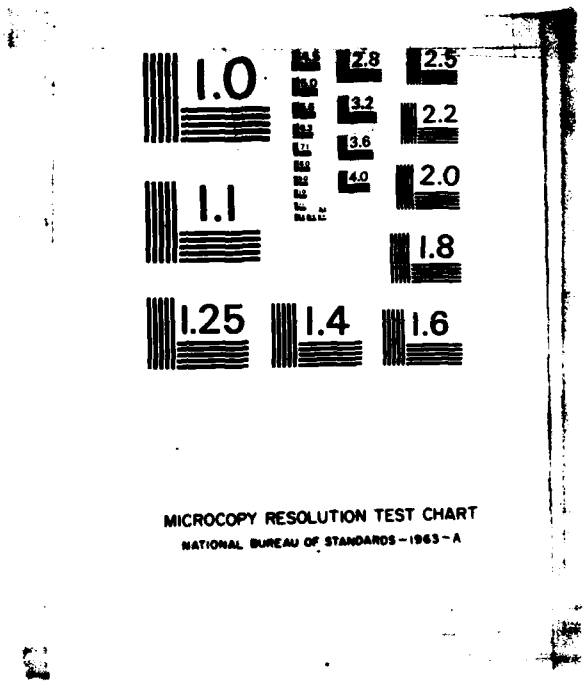
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AIR FORCE HUMAN RESOURCES LABORATORY

INTEGRATED TRAINING SYSTEM FOR AIR FORCE ON-THE-JOB TRAINING: SPECIFICATION DEVELOPMENT

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March 1984
Final Technical Paper

Approved for public release; distribution unlimited.

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instructional management	task proficiency objectives
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mission-oriented training	training program evaluation

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The objectives of this effort were (a) to conduct a system definition study of Air Force On-the-Job Training (OJT), and (b) to prepare a set of functional specifications for an integrated, base-level OJT evaluation and management system with linkages to the Major Commands and Air Staff.

This study was accomplished in four major phases: (a) defining the requirements for an effective OJT system; (b) conducting a feasibility analysis of ITS design alternatives; (c) developing ITS system specifications; and (d) analyzing ITS development and demonstration alternatives. It was concluded that there is great potential for increasing

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training quality control
training requirements management
training resources management

Item 20 (*Continued*)

the effectiveness and efficiency of mission-oriented training by the application of computer technology to the functions of instructional management, scheduling, reporting, external evaluation, and recordkeeping.

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TABLE OF CONTENTS

		Page
I.	INTRODUCTION/BACKGROUND	5
II.	REQUIREMENTS DEFINITION	7
	Technical Approach	7
	Background Information Gathering	7
	Study of Literature Sources and Relevant Directives	7
	Field Visits to Air Force Bases and Agencies	7
	Design for Base Interviews	8
	Definition of Requirements	8
	Determination of ITS Performance Parameters	8
	Development of ITS Design Options	11
	Determination of ITS Demonstration Conditions	11
	Results of Base Interviews	11
	Training Development and Delivery	11
	Training Resource Management	16
	Instructional Management	18
	Training System Management	23
	Definition of Requirements for OJT	26
	A New Concept for Air Force OJT	26
	Factors Considered in Defining OJT System Requirements	29
	Requirements for an Effective OJT System	31
III.	ITS DESIGN ALTERNATIVES/FEASIBILITY ANALYSIS	43
	Description of the Alternatives	43
	Alternative Design Considerations	46
	General Description	47
	ITS Trade Studies Analysis	49
IV.	DEVELOPMENT OF ITS SYSTEM SPECIFICATIONS	53
	General Discussion	53
	ITS System Description	55
	System Overview	55
	ITS Functional Characteristics	61

V. DISCUSSION 79

Critical R&D Issues 79
MTL Construction 80
Identifying Generic Position Training Requirements 81
Constructing Operational Position Training Requirements Task Lists 84
Training Effectiveness Index 85
Input to OS from ITS 87
Training Quality Control 87

Implementation Issues 88

Long Range Implications for Other Manpower and Personnel Functions 91
Classification/Utilization 91
Quality Force/Promotions 91
Manpower 92

VI. CONCLUSIONS 93

BIBLIOGRAPHY 95

APPENDIX A: ITS INTERVIEW PROTOCOL FORMS 103

APPENDIX B: ITS COMPUTER SUPPORT TRADE STUDIES ANALYSIS 139

GLOSSARY OF TERMS 161

LIST OF ABBREVIATIONS AND ACRONYMS 165

LIST OF TABLES

Table		Page
1	Air Force Agencies/Organizations Visited	7
2	Interviews Conducted during Base Visits	9
3	Career Fields Represented at Interviews	12
4	Requirements for an Effective OJT System	35
5	Minimum Requirements for an Effective OJT System	46
B-1	Feasibility of TMSS Alternatives	156
B-2	Projected TMSS Equipment Requirements	157
B-3	Cost Analysis of TMSS Alternatives ($ per Typical Base)	158
B-4	Cost Analysis of ITS Computer Support Systems (10 Year Discounted Life Cycle Costs)	159
B-5	ITS Development/Demonstration Considerations - Comparison of CYBER 73/16 vs PHASE IV/ITS MINI	160

LIST OF FIGURES

Figure		Page
1	Initial Illustrative Model	10
2	OJT, Career Development Relationship	27
3	Major Functional Areas and Components of the Integrated Training System	44
4	Five Processes Required for Effective Job-Site Training	45
5	Iterative Process for Development of ITS System Specifications	54
6	Functional Relationships within the Integrated Training System (ITS)	56
7	ITS Functional Data Base	58
8	Relationships between AF Mission Requirements, Job-Site Training, and ITS	62
9	ITS Specification Tree	63
10	Hierarchical Relationships of ITS Levels of Control	69
B-1	ITS/PDS Relationship	141
B-2	Network Configuration Alternative A - Dedicated Large Scale System	143
B-3	Network Configuration Alternative B - Distributed Mini-Computer System	145
B-4	Network Configuration Alternative C - Major Augmentation of Phase IV Base Level System	147
B-5	Network Configuration Alternative D - Minor Augmentation of Phase IV Base Level System	148
B-6	Procedures for Management of Task Proficiency Training	150

I. INTRODUCTION/BACKGROUND

The objective of Air Force On-the-Job Training (OJT) is to provide, through a planned program at the job site, the qualifications required for acceptable performance in a duty assignment within an Air Force specialty. The magnitude of this training system can best be perceived when considering the complexities of the Major Commands' (MAJCOMs') missions and the technical diversity of the Air Force specialties required to support these missions. In addition, OJT must be a flexible, ongoing process which can respond quickly to changes in systems, missions, production responsibilities, and manning loads, while closely matching the individual airman's assignments and abilities. Job-site training programs must be capable of providing hard evidence of effectiveness in supporting MAJCOM missions in terms of airman proficiency in performing the specific tasks inherent in mission accomplishment, and of efficiency in providing mission-required skills at a reasonable cost. Unfortunately, the Air Force OJT system has, for a number of reasons, been unable to provide such evidence. Some of the factors contributing to this difficulty are related to increasing mission production demands, increasing numbers of tasks to be trained in the OJT setting, inadequate numbers of highly qualified trainers, and the problems associated with developing, delivering, and managing training at the base level. The Air Force recognizes that (a) more emphasis should be placed on training's relevance to mission requirements, (b) better methods should be developed for identifying and updating specific training requirements, (c) task proficiency gained in OJT should be subject to more frequent and valid evaluation, (d) better methods should be used to determine OJT cost and unit capacity to conduct OJT, and (e) training technicians should be utilized as training managers and developers rather than administrators.

The Air Force Human Resources Laboratory (AFHRL) was requested by the Air Staff in 1972 to conduct a large-scale systems analysis of the Air Force OJT program. This analysis resulted in the initiation of a series of studies addressing such areas as OJT cost and capacity, OJT requirements development, OJT task proficiency evaluation, job-oriented reading improvement, and computer applications to mission-oriented training.

The purpose of this effort was to conduct a system definition study of Air Force OJT in order to prepare a set of functional specifications that would enable the Air Force, in a subsequent effort, to develop and implement a computer-based Integrated Training System (ITS) for the development, management, and quality control of OJT. This effort was accomplished in the following four major phases: (a) defining the requirements for an effective OJT system, (b) conducting a feasibility analysis of ITS design alternatives, (c) developing ITS system specifications, and (d) analyzing ITS development and demonstration alternatives.

II. REQUIREMENTS DEFINITION

Technical Approach

The objectives of the initial phase of this effort were: (a) to gather information related to the present Air Force OJT system, (b) to analyze the requirements for improving the effectiveness of the OJT system, and (c) to provide an initial delineation of alternative ways in which ITS could support OJT requirements. The approach to achieving these three objectives is outlined in the following paragraphs.

Background Information Gathering

Current information and policy related to Air Force OJT was obtained by contractor personnel through a review of the Air Force documents and directives and through attendance at workshops and meetings conducted by Air Force OJT personnel.

Study of Literature Sources and Relevant Directives

Using the facilities of the Defense Technical Information Center, computer searches were performed and bibliographies obtained of literature in such areas as management information systems, job training and analysis, computer aided instruction, management planning and control, and configuration management. Documents that appeared to be appropriate for the system definition effort were obtained and reviewed.

Field Visits to Air Force Bases and Agencies

To gain a first-hand understanding of Air Force perceptions on OJT and an automated system to support training at the base level, discussions were held with personnel of the Air Force agencies shown in Table 1.

TABLE 1. AIR FORCE AGENCIES/ORGANIZATIONS VISITED

HQ USAF/MPPT	HQ USAF/LEY
AFMPC/MPCD	ANGSC/TET
AFMPC/MPCR	AFDSDC
AFMPC/MPCRTT	ECI
AFOMC/OMY	AFLMC
AFMEA	3785 FLDTG
AFHP[illegible]D	3700 TTW

Visits were also made to 10 Air Force bases, where interviews were conducted with base personnel concerned with OJT and other base-level training programs. Types of personnel interviewed at these bases, and at three MAJCOM Headquarters, are indicated in Table 2.

Design for Base Interviews

The basis for the design of the structured interviews conducted at the bases visited was an initial illustrative model of ITS provided by the Air Force. In this model, five ITS subsystems were identified, with their corresponding components, as shown in Figure 1. A set of questions was developed for each subsystem to stimulate discussion of the concepts related to the components within the subsystem and obtain perceptions on specific aspects of each component. Many questions were designed for specific levels of positions within the OJT system; a key to these levels was provided for each question. Two additional sets of questions were used, one to gain information on work center-unique OJT policy on such topics as upgrading in skill-level and task proficiency certification, and the other to determine AFS-specific training problems.

As the field visits progressed, the questionnaires were revised to delete those items which elicited standard responses, or no response at all, and to add a few questions on topics which arose more or less consistently during earlier interviews. Final interview protocol forms used are shown in Appendix A.

Definition of Requirements

The requirements for an effective OJT system are defined in the portion of this section entitled "Definition of Requirements for OJT," and are listed in terms of priority or importance for the ITS development effort. These requirements were produced as a result of examining factors in which the present Air Force OJT system is deficient in light of the information gained during the field visits. The factors selected, and a rationale for their selection, are also described.

Determination of ITS Performance Parameters

It had been initially planned to establish performance parameters for each of the requirements that would be identified during Phase I of the project. The parameters would consist of statements of the extent to which the ITS must meet the criteria for an effective OJT system. Because virtually all of the requirements developed represented departures from the capabilities of the present system, substantive information that could be used as a baseline for establishing the parameters could not be obtained from the field visits. However, an attempt was made to identify some of the parametric categories that the Air Force should consider prior to the development, demonstration, test, and evaluation of the ITS. Final performance parameters for the ITS will be established by the Air Force.

TABLE 2. INTERVIEWS CONDUCTED DURING BASE VISITS

BASE/MAJCOM	MAJCOM FUNCTIONAL MANAGERS	MAJCOM OJT STAFF	CBPO OJT UNIT	COMMANDERS	UNIT OJT MANAGERS	BRANCH, SECTION, SHOP CHIEFS	IMMEDIATE SUPERVISORS TRAINERS	AFRES TRAINING MANAGERS	ANG TRAINING STAFF
HQ MAC	X	X							
Scott AFB			X		X	X	X	X	
Bergstrom			X	X	X	X	X	X	
HQ SAC	X	X							
Offutt AFB			X		X	X	X		
HQ TAC	X	X							
Langley AFB			X	X	X	X			
Andrews AFB									X
Kirtland AFB			X	X	X	X	X		
Luke AFB			X	X	X	X	X		
Travis AFB			X	X	X	X	X	X	
Blytheville AFB			X	X	X	X	X		
Little Rock AFB			X	X	X	X	X		

MANAGEMENT FUNCTIONS			SUPPORT FUNCTIONS		
TRAINING DEVELOPMENT AND DELIVERY SUBSYSTEM	TRAINEE MANAGEMENT SUBSYSTEM	EVALUATION & TRAINING ANALYSIS SUBSYSTEM	DATA BASE MANAGEMENT SUBSYSTEM	PERSONNEL SUBSYSTEM	
Task proficiency objectives Job rotation objectives Interface, Occupational Surveys Interface, STSs Training aids Task by position data base	Entry, diagnosis of need Prescription and scheduling Individual training records Unit training records Interfaces-CDC, MMICS, PDS Resource allocation	Individual performance evaluations Cost and capacity analysis Interface, MAJCOM and Air Staff training OPRs	CPU support Communications Terminals System software Applications programs	Organizational and personnel requirements Training requirements Incentive requirements Transition requirements	INITIAL CONFIGURATION: QUALITY CONTROL AND MANAGEMENT ANALYSIS THRUST
Simulation, tasks not found on job Job reading training ISD authoring aids	Skill level indices	Computer-based, performance testing Job reading tests Comprehensive program evaluation	Hardware & software for basewide expansion	Streamlined organization In-house training capability	ADVANCED CONFIGURATION: INSTRUCTIONAL DELIVERY THRUST
AFLMC AFHRL/OR ATC	AFLMC AFMPC/MPCD ECI	AFLMC ATC	AFHRL/OR AFDSDC AFSC/ESD AFMPC/MPCD	Overall AFHRL/ID AF/MPPT AFMPC/MPCRTT Operational commands	PARTICIPATING AGENCIES

Figure 1. Initial Illustrative Model

Development of ITS Design Options

The approach used to develop ITS alternative design options was to identify discrete options for independent aspects of the system, such as the computer network configuration, data base processing, system management functional responsibilities and trainee management support. This enabled configuration of the options in a manner that would allow consideration of a mix of options rather than three or four complete, but inflexible, alternative configurations.

Determination of ITS Demonstration Conditions

Since the ITS will eventually be demonstrated under conditions that will permit evaluation of its characteristics and effects, a set of base, Air Force specialty, and personnel characteristics defining the conditions for such a demonstration was developed.

Results of Base Interviews

At each base, the servicing Consolidated Base Personnel Office (CBPO) OJT Unit coordinated with unit and squadron OJT managers in scheduling the interviews about a week in advance of the visit. Most of those interviewed were in homogeneous groups of supervisors and trainers, or unit OJT managers; groups ranged in size from 3 to 20 individuals. On a typical base visit of 3 days, six to eight groups were interviewed. Each group was provided with a short brief on the objectives of the project prior to discussions of approximately 2 hours in length. The personnel contacted represented 92 Air Force specialties in 30 career fields. The wide representation was a result of the variety of secondary AFSs held by the more than 300 persons interviewed. A complete list of the career fields represented is provided in Table 3. Summarizations of the information gathered during the base visits are presented here in four sub-sections which are related to broad functional areas of an improved model of an effective OJT system. They are (a) training development and delivery, (b) training resources management, (c) instructional management, and (d) training system management.

Training Development and Delivery

The first set of questions posed to the interview groups asked the respondents what could be done to reorient OJT toward mission requirements. The four most frequent responses are listed below. Each response was covered in greater detail through the remainder of the interview. The responses are not rank ordered, but are merely listed in the order in which they were most often discussed with respondents during the interviews:

TABLE 3. CAREER FIELDS REPRESENTED AT INTERVIEWS

20	Intelligence	47	Vehicle Maintenance
21	Audiovisual	51	Computer Systems
25	Weather	54	Mechanical/Electrical
27	Command Control Systems Operations	55	Structural/Pavements
29	Communications Operations	57	Fire Protection
30	Communications - Electronics Systems	60	Transportation
31	Missile Electronic Maintenance	62	Food Services
32	Avionics Systems	64	Supply
34	Training Devices	65	Contracting
36	Wire Communications Systems Maintenance	67	Accounting and Finance, and Auditing
42	Aircraft Systems Maintenance	70	Administration
43	Aircraft Maintenance	73	Personnel
44	Missile Maintenance	74	Morale, Welfare, and Recreation
46	Munitions, Weapons Maintenance, and Explosive Ordnance Disposal	75	Education and Training
		81	Security Police
		90	Medical

1. Make the Specialty Training Standard (STS)/Job Proficiency Guide (JPG) more specific.

2. Eliminate upgrade training per se, and substitute continuous qualification training.

3. Separate OJT from promotion/career development.

4. Eliminate the Career Development Courses (CDCs) as a requirement for OJT.

The following specific areas were then addressed as being fundamental to training development and delivery functions in an effective OJT system.

Task Proficiency Objectives. There was universal agreement across the Air Force specialties interviewed that tasks as presently listed in the STS/JPG are not sufficiently detailed to provide an accurate basis either for developing effective training programs or for evaluating the proficiency of those personnel who have been trained. This problem was found to be more pronounced in dual weapon system wings, such as C-5/C-141 or B-52/KC-135. In those work centers, the tasks listed on the JPG have to apply to both weapon systems, even though the maintenance standards and procedures involved may differ.

With respect to the development of task proficiency objectives, respondents further agreed that, for maintenance specialties, Technical Orders (TOs) could provide some standards, but that standards would be difficult to derive for non-maintenance specialties. The consensus was that the task proficiency objectives should originate with the supervisors. This consensus was qualified, however, by additional comments expressing concern over the administrative burden currently placed on supervisors in the present OJT system.

When asked about the possibility of utilizing occupational survey data to establish task proficiency guidelines, most respondents had no specific opinions. Those that did express an opinion felt that the existing occupational survey methodology could certainly be beneficial in such an effort, but that the data extracted would have to be more detailed to be of real value.

Interface with Occupational Surveys. Additional questions were used to explore in greater detail what relationship, if any, should exist between ITS and occupational surveys. Approximately 90 percent of all those responding at the CBPO, unit OJT manager, and work center levels felt that occupational survey data were not now being effectively translated into OJT requirements. Many noted the lack of feedback to the base level and expressed dissatisfaction with the survey data collection methodology. The 10 percent who expressed satisfaction with the occupational surveys noted that several STSs had been improved after such surveys.

The general view of respondents regarding the advantages to be gained from using occupational survey data to formulate OJT training requirements was that it would establish a useful pool of task information. They felt this would help eliminate guesswork within categories of tasks when the supervisor had to select tasks to train. The primary disadvantage was viewed as being the lack of sufficient detail of the survey data. Some respondents in the Civil Engineering (CE) squadrons believed that this lack of detail had erroneously resulted in some AFSs being combined, thereby complicating the qualification training process (e.g., the merging of the Refrigeration and Cryogenics AFSs).

When asked if they felt that an OJT system in which positions were defined in terms of the specific tasks performed in those positions could generate a task list (similar to a job inventory) for occupational surveys, 80 percent said "Yes"; 10 percent said "Yes, but the task list might pick up too many insignificant tasks"; and 10 percent said "Perhaps" or "Maybe," with no amplifying remarks. Ninety-five percent of the respondents felt that such a system could be used as a validation tool for occupational surveys; that is, it could provide a list of tasks currently being trained to compare against the list of tasks that personnel said they were performing in the field.

All respondents were in general agreement that the MAJCOM functional managers should be responsible for implementing the results of occupational surveys into the OJT system.

Interface with the Specialty Training Standard (STS). The responses to questions regarding the present utility of the STS for OJT use can be summarized as follows:

1. The present STS has insufficient detail or depth to be effective as a document on which to base task proficiency training. An example of this problem was the situation of a shop supervisor whose master JPG for training required 10 full pages of tasks on AF Form 797, Job Proficiency Guide Continuation Sheet.

2. The current Proficiency Code Key was considered inadequate to describe an individual's proficiency, because it was subject to widely varying individual interpretation. Many respondents, from work center supervisors to MAJCOM staff personnel, supported a "go/no go" concept. That is, the individual can either perform the task completely and correctly or cannot perform the task.

3. Many respondents felt that, rather than reflect all general tasks applicable to an AFS as the STS does, a document which provides guidelines for the conduct of OJT should be specific to a duty position.

As to the functions that the STS should perform in an OJT system that is designed to provide only job/task knowledge and proficiency and not career knowledge, some respondents felt that the STS should be used only as a basis for an Air Training Command Course Training Standard (CTS). Others felt that some effort should be made to expand the present STS into a "trainer's guide." This expansion would list tasks performed in an AFS on a specific weapon system.

Perceptions were then sought concerning a more clear-cut division between career knowledge, as outlined in the STS and the Career Development Course (CDC), and job knowledge, which could be delivered using specific job-related instructional materials. The universal response was that career knowledge and advancement should be the responsibility of each individual and should not be managed by the OJT system. This concept was confirmed by virtually all those interviewed. The main thrust of their views was that the CDC contributed little to task proficiency, since CDCs are not job-site related.

Task-by-Position Data Base. The concept of defining a position in terms of the tasks performed in that position appeared to be new to many respondents, and information gathered from questions concerning the identification of positions was meager. Two typical responses concerning the approximate number of positions within a specific area of responsibility were as follows:

1. From a CBPO OJT manager: "Five thousand or so. One position for each person assigned to the base."

2. From the Noncommissioned Officer in Charge (NCOIC) of a missile electronics maintenance shop with 24 personnel assigned: "There is only one position in the shop. Each person is trained on as many tasks as he or she can learn during the assignment." (There were 464 tasks listed on the JPG used in the shop.)

Once the concept of a task-by-position data base was established, the subjects had a frame of reference for further questioning. They proceeded to provide their views on where the responsibility for creating and maintaining such a data base should be vested. The consensus concerning responsibilities for the data base by level of management was as follows:

1. Air Force/Air Staff - define common tasks for all AFSs.

2. Major Command - add mission-oriented tasks by weapon system for each AFS.

3. Branch Chiefs and Section/Shop Chiefs - add local unique tasks.

Respondents felt that the responsibility for ensuring the accuracy and currency of information in a task-by-position data base should be established at the branch level or below.

Generally, respondents believed that anyone charged with the management of OJT should be able to access the data base for inquiries. With respect to updates, however, the general feeling was that they should be made by training management personnel, with supervisor inputs, but only on approval of higher authority.

Since a task-by-position data base could become the basis for generating individual training requirements, respondents were asked for their opinions regarding where and when such training requirements should be generated. The answers fell into two distinct categories:

1. Aircraft maintenance OJT managers and work center supervisors supported the initiation of training requirements by unit OJT managers during airman check-in to the unit.

2. Supervisors in the support functional areas and CBPO OJT managers felt the JPG could be initiated in the CBPO during in-processing of each airman.

Trainer Identification and Qualification. Although this topic was included in the earlier forms of the survey instruments under a general question regarding trainers, subsequent discussions with maintenance training managers on the Strategic Air Command (SAC) staff and the NCOIC of the SAC 3902 Air Base Wing OJT staff highlighted the importance of more positive control over the quality of OJT trainers. This point was specifically addressed in Chapter 5 of SAC Regulation 50-8, Aircraft

Maintenance Training. As a result, a series of questions was incorporated into the interviews to obtain further information during the remainder of the visits.

The nearly unanimous opinion of respondents to these additional questions was that trainers, whether the immediate supervisor of the trainee or not, should be positively identified in an individual's training record. This attitude was coupled with the additional opinions of those respondents regarding the qualifications of trainers, as listed below:

1. Trainers must be proficient in performing the task to be trained and must be capable of training that task.

2. Trainers should receive formal training on how to train.

3. Poor trainers should be "weeded out" of the system.

While these were the expressed opinions of supervisors and OJT managers, it was a common practice in some work centers to assign newly upgraded 5-skill level airmen as trainers prior to their receiving formal "trainer" training. This was due, in part, to the severe manning problems that existed in the middle grades and the backlog awaiting Field Training Detachment (FTD) OJT Advisory Service training.

One problem identified in this general area was related to the training of entry-level airmen in Civil Engineering specialties. In some squadrons, civilian foremen were not providing job proficiency training for these airmen. When work order assignments were made, more proficient civilian workers, who could perform quickly and thus help keep labor costs down, were selected. This resulted in a lack of task training opportunity for the these airmen.

Training Resource Management

One previously identified problem area was the lack of an effective methodology to determine both the cost of OJT and the capacity of units to conduct OJT. Therefore, the specific areas investigated during Phase I of this project were the training aids and instructional technology currently in use by the MAJCOMs and individual bases and units; the availability of resources, including the determination of training capability; the availability and types of cost and capacity data; and scheduling requirements and techniques.

Training Aids and Instructional Technology. A wide variety of training aids were in use at all bases visited. They ranged from the traditional charts, mockups, and simulators to slide/tape presentations that were most often used in a student-paced mode. The Instructional System Development (ISD) process, as it was being applied to unit training, often produced only instruction delivered in slide/tape format. Use of state-of-the-art instructional technology in OJT was not in evidence.

Resource Availability. When asked to what degree equipment was available for proficiency training and testing, respondents provided few insights. One precision measuring equipment laboratory (PMEL) work center was using special equipment on loan from the manufacturer to train personnel. For the most part, however, resources were available when needed for task proficiency training, since the training was generally "unscheduled" in the production environment and occurred only when production generated an opportunity. Resources were available for production, but were reported as difficult to obtain for training purposes only. With the notable exceptions of aircraft weapons loading teams and the Security Police training programs, "actual equipment" resource availability for task proficiency evaluation was minimal.

OJT Cost and Capacity. Respondents were asked where they believed the OJT program, as then structured, was cost effective and where it was not cost effective. Task proficiency training was believed to be cost effective where specific guidelines for delivery and evaluation had been established and enforced. There were a number of areas where the present OJT program was considered to be not cost effective. Among these areas were:

1. OJT documentation requirements, because they prevent OJT managers from performing their primary training functions.

2. Ancillary training requirements, because they were excessive for an already depleted work force.

3. Career development tied to OJT, because of its irrelevance to the actual job and because of the administrative procedures required to manage it.

4. Career Development Courses (CDCs) in technical specialties, because these courses do not increase a trainee's task proficency. In non-technical specialties, the value of CDCs was considered marginal. In theoretical and procedural areas, which did not change appreciably over time, CDCs were felt to be of some value.

An additional point that was introduced by respondents was that completion of a CDC was of more value in studying for the Specialty Knowledge Test (SKT) for promotion than for providing task knowledge. It was noted that some CDCs contain as many as seven volumes, and it may be up to 2 years before the information would really be needed for promotion testing.

Attempts to gather information regarding the costs of OJT proved futile. Some respondents made suggestions concerning types of training costs that could be derived in their areas of responsibility. Several examples are given below:

1. The costs of all computer products associated with OJT.

2. The cost of staff assistance visits, both on- and off-base.

3. Paper costs.

4. Salaries of trainers, trainees, and OJT managers.

Attempts to gain information on the training capacity of a unit or work center were equally unsuccessful. Supervisors reported receiving personnel--apparently for training, since they would be transferred immediately after upgrading--with no advance notice, no course of instruction, and no inquiries regarding their capacity to train any specific number of trainees. Generally, supervisors considered their training capacity to be from one to three 3-level trainees per trainer.

Scheduling Requirements and Techniques. One point became very clear during the base visits: there was an enormous scheduling workload at the base and unit levels. A typical CBPO OJT staff could be required to schedule up to 900 people per month in various training events. CBPO OJT units generally had one person doing scheduling on a full-time basis. In maintenance, wing training management staffs had two or more full-time schedulers, who were provided some assistance in the scheduling processes by the Maintenance Management Information Control System (MMICS) training subsystem on the base computer. However, the time required to load courses and trainees into the base computer and to make updates was considered appreciable.

Instructional Management

In this functional area, an attempt was made to explore how trainee progress was managed within the present OJT program. Elements included the diagnosis of training requirements for newly assigned airmen; the prescription and scheduling of required training; and the creation, content, and handling of training records at the individual trainee and unit levels. Interfaces with the CDC process, the MMICS, and the Personnel Data System (PDS) were explored to determine what data exchanges were made. Questions were included concerning the methods of individual performance evaluation used to assess a trainee's proficiency on tasks that had been trained.

Entry and Diagnosis of Training Requirements. The diagnosis of training requirements was being conducted as part of the supervisor's initial evaluation, which was required by Chapter 4 of AFR 50-23, On-The-Job Training. Respondents were unanimous in declaring that the individual diagnosis of training needs, if automated, should occur at the unit level for support units, and at wing training management level for maintenance units, with verification provided by the appropriate supervisor. It was further agreed that such diagnosis should include all base-level training requirements. As in other conceptual areas, these responses were qualified by the respondents' emphasizing that the administrative load of any diagnosis process on supervisors and OJT managers should be kept to a minimum.

Prescription and Scheduling. Prescriptions for training at the formal course level were relatively structured in the Strategic Air Command. An example was the Job Position Technical Training (JPTT) Program as delineated in SACR 50-8, Aircraft Maintenance Training. The JPTT program included decision tables that specified which training courses were required, based on an individual's primary AFSC, assigned weapon system, and time lapse versus experience factor.

The Security Police training program was also interesting in the area of training prescription and, as will be discussed later, evaluation of training. Security Police positions were task-defined on a modified AF Form 1098, Special Task Certification/Recurring Training, which was referred to as a Duty Position 1098. Study materials for these specific tasks were provided in Educational Subject Block Indexes (ESBIs), that contain detailed information on performing the tasks. Trainees were thus made aware, early in the training process, of exactly what task knowledge and proficiency they would be required to demonstrate after training.

Scheduling problems were found to exist Air Force-wide. Many courses were underutilized, and often classes that were full prior to the class's convening date suffered from high percentages of no-shows. This problem was particularly severe among aircraft maintenance personnel. Pressures produced by high sortie rates discouraged supervisors from releasing people for needed training.

FTD OJT Advisory Service courses had large backlogs at several bases, because of spot shortages of instructors and the numbers requiring training. One base had not had an OJT advisor for nearly 6 months. During that time, new OJT trainers continued to be assigned.

When asked how trainees were scheduled for multi-person (team) task performance training and testing, respondents acknowledged that trainees generally performed these tasks in only one position, with little opportunity to gain experience in other positions. In some consolidated unit training programs, time constraints frequently dictated that some trainees merely watch a task being performed, rather than having a training opportunity to perform the task themselves.

There appeared to be no systematic procedures for providing feedback to trainees through proficiency testing. Aircraft maintenance supervisors usually provided feedback in some form when the trainee received a maintenance standards Quality Control evaluation. These evaluations, however, were designed primarily for assuring the quality of maintenance rather than the quality of training.

In contrast with the generally loose structure of prescribing and scheduling training and evaluation testing for task proficiency, the system for scheduling and tracking CDC volume review exercises (VREs), course examinations (CEs), and review training for CDCs was highly structured, visible, and formalized. For example, when a CE for an individual trainee was received on a base, the CBPO OJT staff normally

notified the unit concerned and established a 30-day testing "window." The unit then had to schedule the person for testing sometime within that 30 days. The test was monitored by CBPO personnel and the answer sheets were scored at the Extension Course Institute (ECI). If an airman failed, the supervisor established review training of 2 hours per day for 30 days, and then the test was taken again. Pass/fail rates were tracked and reported at a variety of levels.

Training Records. Questions about current and future requirements for training records were divided into two groups: Individual Training Records and Unit (aggregate) Training Records.

a. Individual Training Records. Respondents felt that a training record should be initiated on completion of basic military training (BMT), rather than when an individual reports to the first unit. In addition, respondents said that certain pertinent data from BMT, such as reading scores, and information concerning Resident Technical School performance, should be placed in the record.

Little information was obtained concerning squadron/unit requirements for tracking individual trainee progress in OJT. Most interviewees responded that training management took care of tracking. Others quoted the requirements in AFR 50-23. When the question was reworded to ask how trainee progress should be tracked, about 20 percent suggested employing a checklist that could be used to record the number of times a task was attempted before successful completion.

At the time of the field visits for this project, tracking aids in use to monitor the progress of trainees toward task proficiency consisted primarily of the AF Form 1320, Training Chart. There was a provision in MMICS for an automated JPG that was being tested at a few bases. The interviewers were shown sample JPG listings of tasks on which individuals were qualified. A composite listing also provided the percentage of qualification of a trainee; that is, how many tasks had been certified versus the total number of tasks to be trained. There was no provision for reporting how much training an individual had received on a given task that had not yet been certified.

Frequency of access to AF Form 623, On-The-Job Training Record, varied with the level of OJT management. Supervisors would normally require access to an individual trainee's record several times a week. Unit OJT managers would require access to the record at least once a month while the person was in upgrade training, then twice a year after upgrade. The CBPO OJT staff would require access to a record a minimum of twice a year, once on staff assistance visits and once when processing upgrade requests.

The time delay that would be tolerated in obtaining required training record data again depended on the level of OJT management. Generally, supervisors required the data immediately in order to make training decisions. Wing training management in maintenance believed that a 2-hour delay would be acceptable. The CBPO and MAJCOM

Headquarters OJT staffs, because their need was for long-term planning, could accept a delay of 24 hours or more.

Although an AF Form 623, On-The-Job Training Record, need be maintained only for each individual below grade E-7 (and for E-7 and E-8 retrainees), respondents at all levels of OJT management and supervisors in all pay grades felt that the training record should be maintained throughout a person's career, regardless of grade.

b. Unit Training Records. Training records at the unit level consisted mostly of OJT status reports on which were recorded such statistics as the numbers of personnel in overtime training, in excessive training, upgrading to the various skill levels, etc. There were few respondents who felt any real need for manually producing unit training statistics, primarily because they believed any requested data could be compiled when needed for a particular purpose and transmitted over the telephone. However, when they were apprised of the potential for producing continually updated computerized unit training records, they reacted favorably. The following levels of management were perceived to require such aggregate training data:

1. MAJCOM OJT Staff.

2. Wing Commander - on request only.

3. Deputy Commander for Maintenance.

4. Unit Commander - broken out by work center/section.

5. CBPO OJT Staff.

Respondents further felt that statistics related to trainer utilization and training capacity data should be generated to help determine maximum training loads for a given unit, although true OJT capacity values might be difficult to determine.

Interfaces with MMICS and PDS Data Automation Systems. To determine how ITS could best interface with the two primary automated systems which support training, information was sought related to (a) current support of OJT, (b) existing data that were considered useful, and (c) inputs being made by potential users of the ITS. The results indicated that nearly all the training data that existed in both MMICS and PDS were useful to their respective users.

Dissatisfaction was generally expressed by those who were least experienced with the systems, and who therefore could not take full advantage of what was available. One recurring complaint was the lack of space available for data in the MMICS training subsystem and the low priority assigned to training in both MMICS and PDS. Another frequent complaint was the lack of interaction and data flow between MMICS and PDS. Because of the separation of both systems, a great deal of redundant recordkeeping was required.

In the MMICS training subsystem, many managers saw a need for standardized training course codes, so that a course code at one base would be the same for an identical course at another base. This lack of standardization presented a problem when trying to diagnose a newly assigned airman's training needs.

Individual Performance Evaluations. Task proficiency evaluation of individual trainees was considered very important in determining the effectiveness of OJT. "Third-party" task evaluation (that is, evaluation by someone other than the assigned trainer) was becoming more commonplace. But frequently the task evaluator, because of a shortage of experienced people, was the trainee's supervisor. This tended to dilute the potential effectiveness of third-party evaluations.

The Security Police were judged to have an effective system for task proficiency evaluation. Each trainee was evaluated by a representative of a Standardization Board within a specific period of time (typically, 30 to 60 days) after being certified. The trainee had to achieve a grade of 80 percent or better on oral, written, and practical tests covering each task on which certified. Failure on any task automatically triggered retraining on the failed task. A report of the results of the evaluation was forwarded to the trainee's supervisor and the squadron commander.

Outside of the Security Police and Air Traffic Controllers (who use Federal Aviation Administration-certified evaluation teams), task proficiency evaluation was considerably less formalized. Rarely was a squadron commander notified of evaluation results. Additionally, it appeared to be a universal practice that a trainee was evaluated in only one position of multi-person (team) tasks. No explanation was given for this, other than time constraints.

The Maintenance Standards Evaluation Program (MSEP) was believed to have little impact on training except in SAC, where MSEP teams had been chartered to include training evaluations and training assistance to units if requested by unit commanders.

Skill-Level Indices. Originally designated as a possibility for an advanced version of ITS in the Air Force illustrative model, this topic received so much reaction from personnel during the field visits that a decision was made to examine it in greater detail. The Air Force defines the 5-skill level as being the skilled or journeyman level. Airmen at the 5-skill level "have, through experience and training, shown proficiency in their AFS and can be reasonably expected to perform on the job without direct supervision" (AFR 35-1). In reality, this may not be true. It is standard practice across the Air Force, with a few notable exceptions, to upgrade individuals to the 5-skill level at the time of CDC completion. The number of months spent in training closely coincides with the number of volumes in a CDC. Certification of proficiency on the tasks identified on the JPG usually occurs soon after the CDC course examination is passed. The general consensus of supervisors, OJT managers, and trainers in the field was that, at the time of

upgrading, most airmen were not fully qualified in their positions. Airmen in some positions were said to require 2 or more years on the job to achieve full qualification.

Reports and charts examined on the field visits consistently used the number of 5-levels on hand to indicate a desired state of readiness. In actuality the "5-level" airman may be only slightly more qualified than a 3-level and, in some cases, less qualified. It was apparent that personnel were often upgraded in minimum time because of pressures, real or perceived, to produce qualified individuals.

Seventy percent of managers and supervisors were in favor of abolishing "skill levels" altogether, suggesting a system like the Navy's where skill level is inherent in rank. When this proposition was put to personnel at the Air Force Manpower and Personnel Center (AFMPC) who are involved with personnel assignments, they responded that skill levels were essential for making such assignments. However, the perception of personnel in the field was that many assignments seemed to be made without regard to skill levels.

Many respondents felt that some certification indicator could be used based on the numbers and types of positions held in an AFS, the types of tasks performed, and the levels of proficiency demonstrated.

Eighty-five percent of those respondents felt that, at the very least, skill levels should reflect proficiency only in the currently assigned position. For example, an airman who attains a 5-skill level as a Pneudraulic System Technician on an F-111 cannot be expected initially to have the same level of proficiency when transferred to a C-5 wing. The 15 percent who disagreed suggested that a prefix or suffix could be added to the Air Force Specialty Code (AFSC) to indicate qualification. In effect, they advocated the use of additional AFSC shredouts.

When asked what factors should be considered in defining skill levels, the following factors were suggested:

1. Task proficiency and task knowledge.

2. Experience and positions held.

3. Task proficiency and demonstrated management/supervisory abilities.

Training System Management

On the assumption that personnel charged with managing base-level training must have the authority as well as the tools to make the system work, the interviewers probed to determine what functions OJT managers were performing in the present system. From this information, the questioning was expanded to encourage respondents to give their views on ways to improve the organizational structure of OJT and to increase the

training and management utilization of personnel in the Education and Training career field.

Organizational and Personnel Requirements. The concept of a Consolidated Base Training Office (CBTO) was put before the respondents. Most agreed it would be beneficial. Their main stipulation was that it not be combined with the Base Education Services Office, whose function is not directly related to mission requirements. Other suggestions for an organization to manage OJT more effectively at the base level included:

1. Place unit OJT managers administratively under the CBTO, but physically locate them in the unit for which they are responsible.

2. Place an officer in the Education and Training career field in charge of the CBTO who would report to the Wing Commander, or the Vice Wing Commander in his/her capacity as the installation Inspector General (IG).

It was the view of many of the more experienced OJT managers that extensive training would be required for many in the Education and Training career field before they could function effectively as training analysts and developers of effective training programs.

Job Rotation Objectives. At the time of the field visits, little established policy for planned job rotation within units or work centers was found. With the exception of personnel in the Accounting and Finance, and Auditing Career Field, which has a rotation policy, many of those interviewed felt job rotation was wasteful because they believed it meant giving up a fully qualified person for an unqualified person. A few supervisors recognized that carefully managed job rotation could increase their overall readiness level and add to the work center's capability to meet contingencies. Possible constraints on an Air Force job rotation policy were considered to be supervisor reluctance and the additional cost of training. An increase in airman motivation was considered a potential benefit of such job rotation.

Interface with MAJCOM and Air Staff Training OPRs. An effort was made to determine not only the interfaces that then existed between the OJT program and MAJCOM and training Offices of Primary Responsibility (OPRs), but also the additional information reports or products that would be required to enhance the effectiveness of OJT.

Generally, the MAJCOM OJT staffs and other training OPRs felt that they had been kept adequately informed of problems within the OJT system. The results of interviews conducted at the unit and work center levels in many instances appeared to indicate just the opposite. Supervisors and unit OJT managers seemed frustrated by a perceived inability to effect meaningful changes within the OJT system. Consequently, the upward flow of information concerning real problems was somewhat limited.

There were isolated instances where, when staff assistance visit reports detailing training problems were submitted by conscientious OJT managers, the reports were allegedly modified by superiors to reflect more favorably on a unit's training program.

At the MAJCOM level, respondents were asked what additional reports or statistics would be desirable. Some of the more pertinent replies are listed below:

1. Experience quantification (a Special Experience Identifier [SEI] with a clock on it).

2. The number of career staff sergeants not in OJT.

3. Base-level report of problems in CDC performance (by AFS).

When asked what effectiveness measures were used by higher authority to evaluate a unit's training program, a few respondents referred to task performance and documentation accuracy. The question was then rephrased to ask what measures could be used to evaluate a unit's training program. The results were disappointing. Some suggestions made were to use some sort of unit productivity analysis and to use the results of third-party proficiency evaluations.

Incentives. In the present OJT system, the only incentives awarded relate to upgrade of trainees based on completion of CDCs and the course examination grade. There were no incentives being provided for trainers. Several respondents suggested that the Airman Performance Report (APR) was an incentive to gain task proficiency, but questioning in this area did not produce substantive support for this. Every enlisted person in the Air Force is evaluated in six areas on the APR. Only one of those areas relates to job performance in terms of technical task proficiency. NCOs have a separate area for management and supervision which becomes more relevant as grade increases. The evaluation in each area can range from 0 to 9; however, most personnel viewed an evaluation of 8 as detrimental to their prospects for advancement and to their careers in general. Consequently, many reporting officials have been reluctant to assign any evaluation grade of less than 9 for fear of adversely affecting the career of an otherwise average airman.

Evaluation of Training Effectiveness in Meeting Mission Requirements. In answer to questions related to training effectiveness in meeting mission requirements, the responses revealed two basic perceptions on how training effectiveness is evaluated. Management personnel in the work center indicated that the effectiveness of OJT was generally measured by how well a task was performed by individuals. On the other hand, training OPRs at higher levels tended to believe that training effectiveness was measured by how well a unit performed its mission.

OJT managers at the CBPO level believed that staff assistance visits adequately assessed the effectiveness and efficiency of OJT, but they were discouraged when reports of the visits were "toned down."

Additional training effectiveness measures suggested were:

1. Third-party task evaluations.

2. CDC pass/fail rates.

3. Number of 5-levels.

Statistics that were considered by respondents to be significant in evaluating OJT included the number of people enrolled in upgrade training (UGT) and the number of upgrades per month. Respondents acknowledged that, as UGT was then being tracked, such statistics had little relevance, but they pointed out that this was better than having no measures of OJT effectiveness.

Definition of Requirements for OJT

This section provides discussions of the conclusions reached during this phase of the system definition effort relative to (a) a new approach for Air Force OJT, (b) the factors considered in defining system requirements, and (c) categorization of the requirements. It should be noted at this point that the base visits and other work performed during this phase resulted in an OJT concept that is worthy of serious consideration if an effort to reorient base-level training to mission requirements is to succeed. This concept is one in which the objectives of job-site training and the objectives of career development are clarified with respect to mission accomplishment.

Within the present OJT system, career development receives more management support and attention than does job proficiency. This apparently is a result of the availability of study materials of a general nature for career development, but at the same time, little structure and few available materials that are specifically designed for proficiency qualification in a duty position of an Air Force specialty. The relationships depicted in Figure 2 are considered to be a valid basis for altering the present emphasis on use of OJT as a management tool for monitoring career development, to more of a mission-supportive qualification training management and evaluation system.

A New Concept for Air Force OJT

The greatest interest shown by supervisors and trainers during the base visit interviews centered around the topics related to upgrading in skill level. What emerged from these discussions were perceptions that skill levels do not provide accurate indications of actual job proficiency, and that they serve only as an indication of promotion readiness. It was noted that upgrades in skill level are awarded essentially on the basis of CDC completion and meeting time

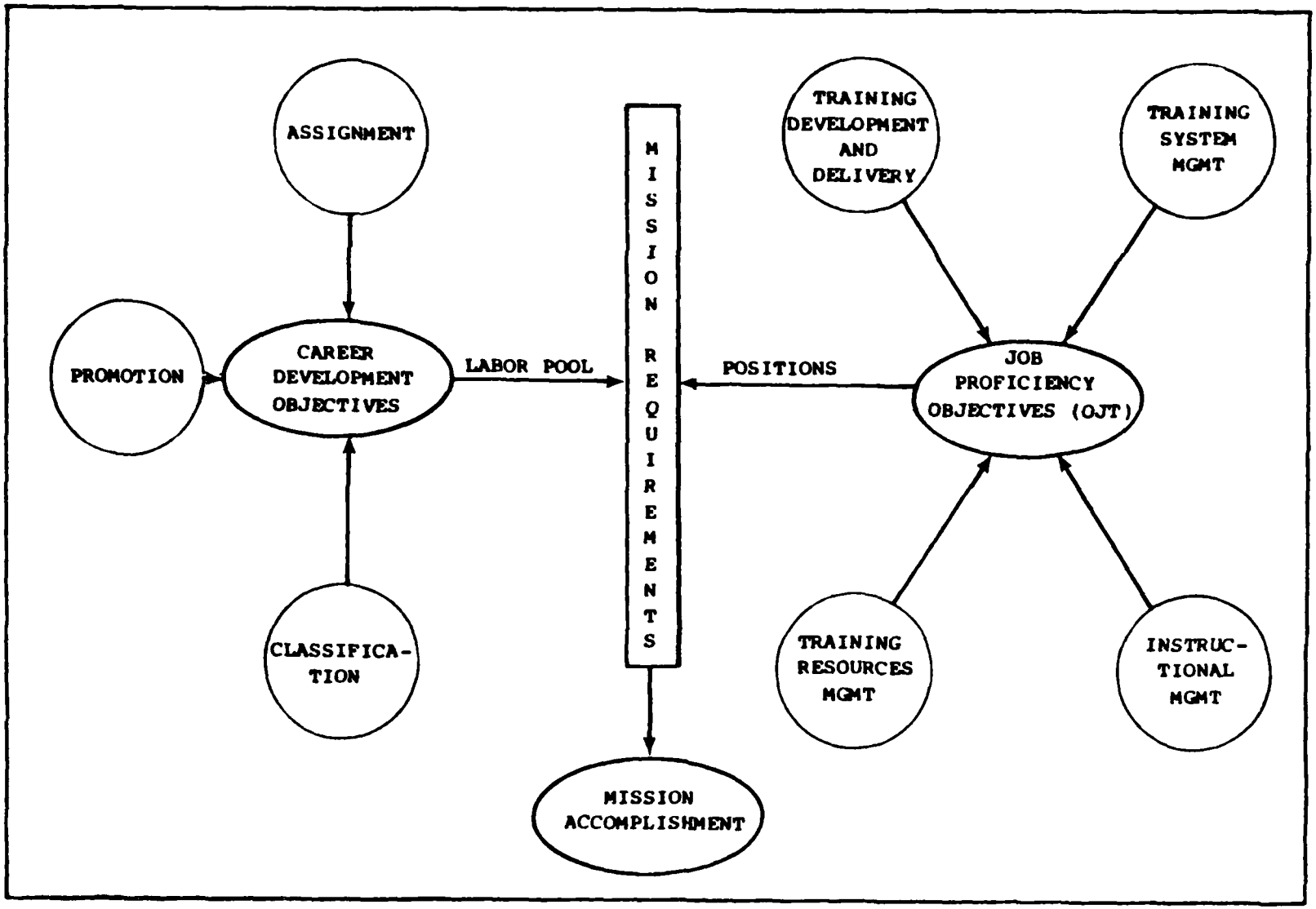

Figure 2. OJT, Career Development Relationship

requirements; that is, seldom are airmen not upgraded because of deficiencies in task performance qualifications. This, in effect, has oriented the Air Force OJT program primarily toward management of qualification for promotion. Virtually all supervisors interviewed believed that if such promotion qualification were made the responsibility of each individual airman, there would be little adverse impact on the numbers promoted or on retention of first-term airmen. Thus, a redirection of the emphasis of Air Force OJT away from upgrade training management would do much to remove the pressures to certify airmen on tasks for which they have not demonstrated proficiency. More emphasis could then be placed on the management of job qualification training, as opposed to career knowledge training, with a more substantive linkage to the mission requirements.

There would be several interesting features of a work center/section job qualification training program managed and supported by the ITS. The basic element of training would be the task to be trained, so that relevant materials could be gathered and/or developed and delivered in a systematic fashion. Data related to the training of, and qualification on, each task would provide a basis for assessing individual progress toward full qualification in a position and the effectiveness of the unit training program in meeting mission requirements. Training would be an ongoing process, in that the target date for full position qualification would not be based on an arbitrary minimum or maximum number of months of service in the Air Force. Instead, the time required for full position qualification would depend upon the complexities of the tasks within the position, the aptitudes and previously attained skills of the individual trainee, and records of training provided for the position in the past. And finally, individual career development could be assessed more accurately in terms of qualification attained in specific positions during a career, and job rotation policies for Air Force specialties could be established to benefit both the Air Force and the individual airman.

Projected automation aspects of the ITS, particularly training qualification records inquiry possibilities, elicited much support from virtually all training technicians and most supervisors. This was considered to be a strong indication of the requirement for an OJT documentation process as "paperless" as it is possible to achieve. However, most of those interviewed cautioned against generating time-consuming data input procedures in a new system which would prove to be as much a burden in the work center as the present "paper" documentation and forms flow. Related ITS concepts that were well received were automated generation of individual training requirement listings, detailed tracking of trainee progress toward task proficiency, and providing a comprehensive record of all training received by an individual airman during a career.

The relationship between the ITS, which would provide management, evaluation and other support for Air Force OJT, and the need for better management of related base-level ancillary training requirements must also be addressed. The ITS design goals focus specifically on the

identification of tasks to be trained, managing trainees to a high level of qualification in a position, and the quality control aspects of such training. While most ancillary training requirements do not lend themselves to precisely the same kind of instructional management approach, the capabilities would exist in the ITS to support these requirements at the base level in such functional areas as tracking, scheduling, recordkeeping, reporting, and, where appropriate, pre- and post-testing evaluation procedures. To the extent possible, such capabilities should be provided for ancillary training in the ITS, so that efficiencies in meeting these types of training requirements can be gained.

Factors Considered in Defining OJT System Requirements

The difficulties which had plagued the Air Force OJT program in the past, and the lack of acceptance of some of the program's philosophy and procedures on the part of MAJCOM functional managers, have been due in large part to the inability of the system to provide evidence of its effectiveness in producing job-qualified airmen. Data have been plentiful to support tracking progress toward career development (CDC completion), but little, if any, data have been generated relative to the outcomes of task proficiency training. An "effective" work center/section training program has generally been considered to be one in which documentation of records was acceptably accurate and in which the overtime and excessive training rates were kept to a minimum. It was evident that quite different factors should be considered in defining the requirements for a more effective OJT system. These factors are as follows:

- Responsiveness to mission priorities.
- Provision for skills required only for contingency operations.
- Assurance of proficiency following OJT.
- Optimal utilization of training resources.
- Cost control.
- Management information.

Responsiveness to Mission Priorities. This critical factor addresses the need for job-site training to result in the capability of the work center/section to accomplish its mission through the performance of tasks which are directly related to mission requirements. For this to occur, the primary emphasis in OJT must be placed on providing airmen assigned to positions within an Air Force specialty with the specific skills required for the day-to-day production of the work center. Emphasis on requiring career knowledge training (that is, knowledge of tasks, jobs, and missions within the specialty not related to an airman's present assignment) would not consider the mission responsiveness factor as being the key to effectiveness of OJT. Career

development could reasonably be considered to be a secondary function of having received qualification training leading to proficiency in a variety of positions within an Air Force specialty throughout an Air Force career, as opposed to making it a first-term upgrade training objective.

Provision for Skills Required Only for Contingency Operations. Some skills which airmen must gain are required only during contingency operations. This factor was considered in defining ITS system requirements for OJT, since it is probable that a large portion of the available production time should be devoted to such training. The need to consider the effectiveness of training for qualification in contingency operations skills is no less important than for skills required for daily production.

Assurance of Proficiency Following OJT. One of the major factors contributing to lack of support in the operational environment for OJT is the absence of standardized procedures for quality control of job-site training. In those few functional areas where training quality control measures are regularly employed, such as standardization boards in Security Police squadrons, positive effects have been observed by unit training managers. It should be noted that production quality control (QC) functions, such as aircraft maintenance QC and the Maintenance Standardization Evaluation Program, do not appear to have observable positive effects on the conduct of training in the work center or on attainment of task proficiency. Requirements for a new Air Force OJT system should address provisions for a training quality control function directly concerned with the effectiveness of qualification training assessed through systematic task proficiency evaluation procedures.

Optimal Utilization of Training Resources. This factor, also considered in defining system requirements for ITS in support of OJT, addresses several deficiencies in the present OJT program related to the availability and scheduling of resources required to support base-level training. If OJT is to be responsive to mission requirements, equipment and human resources must be identified, procured, and allocated considering appropriate forecasts of training loads and the relative importance of the tasks to be trained to the mission. Resource allocation and scheduling processes should be efficient and flexible from the standpoint of integrating work center production workloads with the training to be accomplished.

Cost Control. The ITS requirements definition process considered the fact that the absence of cost data in the present OJT program is a major deficiency that precludes accurate assessment of the efficiency of base-level training. Significant decisions concerning strategies to be used to meet training requirements are now necessarily made based on inadequate cost information. An effective OJT system's requirements should specify that cost data be gathered for use in the analysis and control of costs for all base-level training.

Management Information. Traditionally, Air Force training management at all levels has been provided with statistics related to the upgrading-in-skill-level process in general, focusing specifically on time in training prior to CDC completions. The detailed information necessary to assess OJT's responsiveness to mission requirements by providing job qualification was another factor considered in the ITS requirements definition. An effective OJT system should not only generate task proficiency and other performance data on a routine basis as training occurs, but should be capable of reporting the data in a form which can be readily utilized by decisionmakers and training managers at various levels.

Requirements for an Effective OJT System

An effective OJT system should qualify airmen to perform at predetermined proficiency levels in their assigned duty positions as defined by the tasks performed in those positions. Since the position is the means through which a work center accomplishes its mission, the degree to which the work center meets the requirements of the mission is a function of the numbers of airmen who are qualified to perform the tasks of their positions. On-the-job training, then, to be responsive to this requirement for position qualification, should (a) focus on task proficiency and qualification training, (b) provide qualified airmen for each position in the Air Force, (c) be able to provide valid information related to its effectiveness in training airmen to fill positions, and (d) have a high degree of flexibility to adjust to changes in mission at any organizational level.

Task proficiency training, if it is to result in full position qualification, should be provided at the job site. This would provide for the optimum utilization of existing operational resources, but more importantly, it would provide a measure of confidence that task proficiency certification following training was a meaningful event that occurred in the production environment.

Job-site training has been considered to be difficult to develop, deliver, and manage because of the pressures of production, shortages of qualified trainers, and lack of task training opportunity. These types of job-site training problems cannot be resolved until more use is made of Instructional System Development processes in the design of OJT programs. An effective OJT system should include provisions for structuring job-site training in a sequence of educationally sound steps leading to job qualification. Further, a trainee's progress in achieving the objectives of the training should be managed on an instructional assignment-by-assignment basis. Tests of both knowledge and proficiency should be administered to ensure the achievement of skills in the most effective sequence and to ensure the validity of the training program. The performance data that can be generated through an appropriate trainee management process, when compared with mission requirements stated in terms of the tasks that must be performed, can provide measures of training effectiveness heretofore unavailable for Air Force OJT.

Many trainees, trainers, immediate supervisors, unit OJT managers, and others involved with the training process are dedicated to providing quality training. The award of the few positive incentives for such dedication has been based in part on the formalities of documentation and tracking. In a more effective OJT system, individuals who demonstrate effectiveness in linking the training program more closely to task proficiency requirements could be identified, and incentives could be provided based on contributions to mission capability.

Training-related deficiencies in the readiness posture of Air Force organizations have been difficult to isolate from the total set of logistics, organizational, environmental, job characteristics, and other problem areas. An important factor related to this difficulty has been the inability of the present OJT system to generate data of the kinds needed to assess the impact of training on readiness. To ensure effectiveness, the OJT system should generate these and other appropriate data as a function of each unit's continuous training activity for use in identifying the strengths and weaknesses of the training program. This concept should be extended to provide an interface with Air Force occupational survey activities intended to provide data for making formal training relevant to jobs within specialty areas.

Job-site training resources, which are for the most part production resources, have not in all cases been efficiently allocated with respect to criticality of training to mission accomplishment. This lack of prioritization has been evident in the competition for scarce equipment, instructional media, and qualified human resources in the production environment. Such a situation affects the ability of supervisors and training managers to forecast training loads accurately, to estimate training capacity, and to account for the costs of training in the operational setting. The OJT system should provide an effective means of identifying, accounting for, and allocating training resources based on mission requirements and cost.

Finally, to address requirements for the development of the Total Force and to provide a responsive capability to meet Trained Personnel Requirements (TPR), an effective OJT system should have the capability to collect valid training performance and qualification data that could be provided to the assignment, classification, promotion, and other personnel systems of the Air Force.

The specific requirements for an effective OJT system defined in this section have been categorized into four functional groups as follows:

1. Training development and delivery.
2. Instructional management.
3. Training resources management.
4. Training system management.

Each requirement addresses one or more of the factors discussed in the section on "Factors Considered in Defining OJT System Requirements." A further categorization by training system component area has been made within each of the four functional categories. The order in which the component areas are listed within each category represents their estimated importance relative to the operation and maintenance of the total Air Force OJT system.

Training Development and Delivery Requirements. This category of system requirements includes components that (a) provide a basis for the design of a work center/section training program, (b) help to ensure that the training developed is relevant and responsive to the mission, and (c) establish a baseline for the measurement of task proficiency and the assessment of job qualification. Additionally, these training development and delivery components are intended to facilitate the introduction of training delivery technology into the job-site training environment as a function of Air Force ISD policy.

Instructional Management Requirements. This category of system requirements establishes the need for (a) accurate diagnosis of training deficiencies with respect to the task proficiency requirements for a position, (b) managing the individual trainee's progress toward job qualification, and (c) maintaining definitive information concerning training required, training in progress, and training certified at the individual trainee, work center/section, and squadron/unit levels. The system components that are fundamental to these functions are (a) the airman training record component (a comprehensive account of training completed and skills achieved, for each airman) and (b) the trainee management component, which would provide capabilities to manage all aspects of the airman's currently required training. The interactions that take place between these components and the resultant data generation would provide the capability to produce meaningful information for managers concerning the degree to which training meets mission requirements.

Training Resources Management Requirements. The control, allocation, and scheduling of all base-level training resources are the primary objective of this category of system requirements. Training resources management is one of the more critical factors in determining not only the costs of on-the-job training but also training capacity and capability. Effective training resources management encompasses both human and non-human elements. Further, the resources which limit the amount and kind of training that can be provided is of serious concern when responsiveness to mission requirements must be evaluated and when forecasts of training pipeline bottlenecks must be made. Finally, to ensure that job-site training is delivered with minimum impact on unit production, an efficient, base-level scheduling component should be provided.

Training System Management Requirements. This category of system requirements directly addresses providing capabilities for maintaining (a) the effectiveness and efficiency of job-site training, and (b) the

accounting and control of costs associated with such training. Of major importance in achieving Air Force training objectives is the quality control component. Requirements for training QC must be met to ensure that training resources are not wasted and that all elements of the system function as required. Training cost control requirements address providing the capability to monitor and to increase the efficiency of base-level training, a prime consideration in a climate of severe budgetary constraints. It is by the information provided through this component that funding requirements for OJT can be identified and projected as mission and training loads change. The OJT system should be capable of interfacing training data with other Air Force data and support systems so as to enhance the effectiveness of each of the interfacing systems. Key relationship requirements have been identified and described in the management information interface component.

The requirements that were defined for an effective OJT system are listed in Table 4.

TABLE 4. REQUIREMENTS FOR AN EFFECTIVE OJT SYSTEM

TRAINING DEVELOPMENT AND DELIVERY

A. Task-by-Position Data Base

1. Provide a means to establish and maintain a master task list containing tasks applicable to specialties within the Air Force.

2. Provide a means to standardize the identification of each task on the master task list in order that task certification/ proficiency may be accounted for universally throughout the Air Force.

3. Provide a means to establish and maintain a list of tasks on the master task list assigned to positions in a work center/section that are related to mission accomplishment and for which training is required on the job.

4. Provide a means to augment the position training requirements list with local unique tasks for which training is required on the job but which are not yet established in the master task list.

5. Provide a means to review all local unique tasks within a specialty for commonality and for possible inclusion in the master task list.

6. Provide a means to add tasks, delete tasks, and make revisions to tasks on the master task list as required by changes in weapons sytems, contingencies, variations in specialty requirements, reorganizations, etc.

7. Provide a means to add, delete, and make revisions to the position training requirements list as a result of changes in weapons systems, contingencies, significant variations in workload, reorganizations, etc.

8. Provide a basis for comparing an airman's previously acquired skills with the task proficiency requirements of a position for the purpose of generating a diagnosis of the training required for total qualification in the position.

9. Provide a basis for comparing an airman's previously acquired skills with the task proficiency requirements of a position for the purpose of allowing position reassignment and job rotation decisions.

10. Provide a basis for the analysis of Air Force occupational activities.

11. Provide a basis for the analysis of job training activities within Air Force specialities for the enhancement of Specialty Training Standards (STSs).

B. Task Proficiency Objectives

1. Provide a means to identify and define, in specific terms, the behaviors, conditions, and standards related to each task to be trained.

2. Provide a means to determine if an airman is qualified to perform a task in his/her assigned duty position after task proficiency training on that task.

C. Instructional Technology

1. Provide a means by which job-site training for a position can be structured in a sequence leading to job qualification.

2. Provide a means to ensure that trainees are initially assigned instructional materials which provide the task knowledge prerequisites before task practical training begins.

3. Provide a means to ensure that when trainees do not meet task knowledge prerequisites, they are provided with comments which include such information as which learning objectives have not been attained, where the specific information related to those objectives can be found, and the identification of a test to be taken after restudy.

4. Provide a means to ensure that trainees are assigned associated practical training on a task after meeting task knowledge prerequisites.

5. Provide a means to ensure that a capability for making multiple practical assignments exists in those instances where task knowledge prerequisites have been met but task practical training cannot follow immediately.

TABLE 4. REQUIREMENTS FOR AN EFFECTIVE OJT SYSTEM (Cont'd.)

C. Instructional Technology (Cont'd.)

6. Provide a means to produce a list of study references and other resources required for each assignment, information as to what parts of the references are applicable to the objectives of the assignment, a reference to the test which will be administered upon completion of study, and an estimate of the time (contact hours or days) required for completion.

7. Provide a means to generate knowledge tests randomly from selected sets of parallel forms, and to format tests using items randomly selected from banks of test items indexed to learning objectives as determined in the task proficiency training development process.

8. Provide for the construction, administration, scoring, evaluation, and performance data recording of OJT testing.

9. Provide a means of assisting supervisors in sequencing of job tasks for training on an individual basis, considering task difficulty, training opportunity, frequency of performance, production workload, resources availability, prerequisites acquired, and training difficulty.

10. Provide a means of allowing deviations from optimum sequencing of task practical training assignments as production/operational workloads dictate, and of recording these deviations in trainee records and training validation records.

11. Provide a means of making assignments to modules of instructional materials, individualized or trainer/instructor-delivered, for a task in a normal sequence which is determined during the course development process to be optimum, and which cannot be changed by other than course developers.

12. Provide an assignment strategy by means of which a trainee, if not fully position qualified, has at least one incomplete assignment which is related to a task identified for his/her position.

13. Provide data to support the decisions related to media selection which result from the application of ISD principles to OJT development.

14. Provide data to support the decisions related to the sequencing of instructional activities which result from the application of ISD principles to OJT development.

15. Provide data to support the decisions related to the identification of training resource requirements which result from the application of ISD principles to OJT development.

16. Provide data to support the decisions related to the development of, and revisions to, instructional materials which result from the application of ISD principles to OJT development.

17. Provide data to support the decisions related to instructional material validation which result from the application of ISD principles to OJT development.

18. Provide data to all management levels within the OJT system which depict the results of the application of ISD principles to the OJT system.

19. Provide a means to identify the total set of learning objectives related to each task to be trained.

20. Provide a means to establish and maintain the detailed training task requirements and associated minimum proficiency standards for each duty position in a work center/section.

21. Provide the capability to interface with computer-based simulation technology in the specific areas of establishing the requirements for simulation and in the collection and evaluation of both trainee and simulator performance data.

D. ISD/Authoring Aids

1. Provide a means to identify each training task, learning objective, and test item that might require modification when changes occur in weapon systems, operating procedures, maintenance procedures, etc.

2. Provide a means of facilitating the updating of instructional materials, tests, and task training data utilized in the training system when required by changes to weapons sytems, operating and maintenance procedures, etc.

TABLE 4. REQUIREMENTS FOR AN EFFECTIVE OJT SYSTEM (Cont'd.)

D. ISD/Authoring Aids (Cont'd.)

3. Provide a means of facilitating the distribution of revisions to instructional materials, tests, and task training data utilized within the training system when required by changes to weapons systems, operating and maintenance procedures, etc.

E. Job Reading Training

1. Provide a means for diagnosis of trainee deficiencies in job reading skills.

2. Provide a means to integrate with task proficiency training, the administration of job-related reading skill training.

INSTRUCTIONAL MANAGEMENT

F. Airman Training Record

1. Provide a means to establish and maintain in a common format, an individual airman training record which will include standardized information related to formal resident technical schools training, task proficiency training, ancillary training, war skills training, cross-utilization training, enroute training, and other base-level training, which can be forwarded to each base of assignment throughout the airman's career.

2. Provide a means to record the attainment of job task skills within an Air Force Specialty when those skills are certified at the resident technical school or FTD.

3. Provide a measure of current position qualification in each airman training record which reflects the task proficiency qualifications of the current position.

4. Provide a measure of current AFS development in each airman training record which reflects the numbers and types of positions held and degree of qualification attained in each.

5. Provide a means of informing trainees of their progress toward proficency on all tasks for which training is being accomplished and which must be certified. Such information should include, as a minimum, which milestones (knowledge and skill tests) have been sucessfully met, which have not, and the time which has elapsed since each outstanding assignment was made.

6. Provide a means to collect and maintain information related to the personal attributes of an airman (Armed Services Vocational Aptitude Battery [ASVAB] scores, age, education, pay grade, rank, years service, etc.) that may be used in assessing the progress of each trainee toward proficiency.

7. Provide a means of identifying those trainees who demonstrate initiative in their progress toward proficiency in those tasks identified for their positions, so that equitable incentive awards can be made.

8. Provide a means of identifying those trainess who do not make adequate progress toward proficiency in those tasks identified for their positions, so that counseling and other remedial measures can be provided.

G. Diagnosis of Individual Training Requirements

1. Provide tools for evaluation of a newly assigned airman's previously attained skills against the tasks to be performed in the position and produce a list of tasks for which training is to be provided, sequenced for management of the airman's progress toward job qualification.

2. Generate lists of individual training requirements when cross-utilization training, unit training such as "Prime Beef," war skills training, small arms training, ancillary training, or other requirements occur that are not directly associated with the assigned position within the work center/section.

H. Trainee Management

1. Provide tools for making routine, preferred assignments of job tasks for individuals based on optimum training sequence for full job qualification.

TABLE 4. REQUIREMENTS FOR AN EFFECTIVE OJT SYSTEM (Cont'd.)

H. Trainee Management (Cont'd.)

2. Provide information for the immediate supervisor to be used in making assignments of job tasks out of normal sequence when workload conditions dictate and prerequisites are satisfied.

3. Provide assurance that routine assignments to learning activities are made in a systematic manner once a job task is assigned.

4. Provide assurance that task knowledge prerequisites have been met before practical training on that task begins.

5. Provide assurance that, in the event that task practical training is delayed, task knowledge has not decayed to a less-than-acceptable level.

6. Provide a means to account for practical training time accumulated for each task that occurs in the normal sequence of learning activities for that task.

7. Provide for the collection, recording, and reporting of all trainee performance data related to the learning activities which result in task proficiency.

8. Provide information for the trainer related to the trainee's performance on all learning activities associated with that job task prior to the start of practical training.

9. Provide for the recording of the date on which the trainer determines that the trainee has reached an acceptable level of proficiency on job task performance.

10. Provide to the immediate supervisor (or other designated certifying official) prior to the task certification process, information related to the trainee's performance on learning activities associated with that job task.

11. Provide support for the certification process through evaluation of oral, written, and/or task proficiency testing in accordance with job proficiency objectives, the recording of results, diagnosis of deficiencies, and assignment of appropriate remedial learning activities.

12. Provide support for the external evaluation process after proficiency on a task has been satisfied, in the specific areas of testing, recording, reporting, and diagnosis of deficiencies.

I. Unit Training Records

1. Provide a capability for recording training, certification, and qualification data at the work center/section level.

2. Provide summary reports of training, certification, and qualification at the work center/section, squadron/unit, base, and MAJCOM levels.

TRAINING RESOURCES MANAGEMENT

J. Training Resource Allocation

1. Provide a means to establish and maintain an inventory of training resources required to provide job qualification for every position on a base and required to conduct other base-level training. The inventory will include instructional materials and technical data relevant to each task to be trained, training aids, training devices, training facilities, *operational equipment, supplies,* and human resources required for training.

2. Provide a means of identifying, accounting for the utilization of, and allocating scarce training resources. Factors which will be considered in the designation of a training resource as "scarce" include quantity, criticality to mission accomplishment, cost, production backlog, and training backlog.

3. Provide a means to determine training resource availability so that a comparison can be made with individual and group training priorities to ensure efficient scheduling.

4. Provide a means of holding in suspense records of training, certification, and external evaluation events which are deferred because of non-availability of training resources.

5. Provide a means of receiving information from trainers and instructors related to utilization of training resources; e.g., time use begins and ends, specific events, etc.

TABLE 4. REQUIREMENTS FOR AN EFFECTIVE OJT SYSTEM (Cont'd.)

J. Training Resource Allocation (Cont'd.)

6. Provide a means of assisting the supervisor in obtaining training resources for task proficiency training which is normally scheduled by the supervisor.

7. Provide a means of supplying projections of resource availability to the scheduling function, and of verifying availability prior to schedule promulgation.

8. Provide support for the certification and external evaluation processes through allocation of resources as required.

9. Provide a means of assisting supervisors in sequencing task proficiency practical training for individuals by providing current data on resources availability.

K. Scheduling

1. Provide a means of forecasting, prioritizing, and scheduling all training, certification and recertification events on a base.

2. Provide information related to the scheduling of training to the training resource allocation function for the optimal allocation of such resources.

3. Provide, for all squadrons/units on a base, forecasts and schedules of training and recertification events.

4. Provide a capability for adjustment of training schedules by supervisory and management personnel if required to compensate for unexpected workloads, contingencies, etc.

5. Provide reports for training system management which are needed to assess the effectiveness of the scheduling function.

6. Provide a means for scheduling external evaluation events so as to minimize the impact on work center/section production.

7. Provide information concerning scheduling efficiency for use in OJT cost accounting and control.

8. Provide a means of identifying alternatives to projected training events for which resources will not be available.

TRAINING SYSTEM MANAGEMENT

L. Training Quality Control

1. Provide a single training management focal point at each Air Force base whose sole responsibility is to ensure that all base personnel meet the task proficiency standards required to satisfy mission requirements.

2. Provide management controls necessary to ensure that OJT development is conducted in compliance with Air Force ISD policy.

3. Provide for adjustments in job-site training programs to accommodate changes in training requirements.

4. Provide a means of establishing performance standards for unit OJT managers, trainers, and other personnel directly involved with on-the-job training.

5. Provide systematic task proficiency evaluation procedures which are external to the work center/section in which task proficiency is certified.

6. Establish and maintain baseline data for each work center/section to be used in the assessment of unit training effectiveness.

7. Provide analyses of the data generated by the training system to determine the effectiveness of all training conducted at the base level.

8. Provide for an exchange of information with aircraft and missile maintenance quality control, standardization evaluation, and other quality assurance organizations for the purpose of identifying training-related deficiencies in the operational environment.

9. Provide, for MAJCOM training managers, analyses of the effectiveness of unit training in meeting mission requirements.

10. Provide management controls for the addition, deletion, and revision of tasks on the master task list as required by changes in weapons systems, contingencies, significant variations in workload, reorganizations, etc.

TABLE 4. REQUIREMENTS FOR AN EFFECTIVE OJT SYSTEM (Cont'd.)

L. Training Quality Control (Cont'd.)

11. Provide management controls for the addition, deletion, and revision of tasks on the position training requirements list required by changes in weapons systems, contingencies, significant variations in workload, reorganizations, etc.

12. Provide a means of identifying those individuals who possess the attributes of good trainers.

13. Provide a means of monitoring trainer qualifications to train specific tasks.

14. Provide information related to trainer performance in training specific tasks.

15. Provide a means of identifying and measuring trainer proficiency with respect to those instructional procedures and tasks which promote trainee proficiency.

16. Provide a means of establishing an audit trail which will allow correction of skill deficiencies in trainers if trainee performance so warrants.

M. Training Cost Control

1. Provide a cost accounting and control methodology which can utilize information from the training resource allocation, scheduling, trainee management, and other system functions to provide periodic reports of costs in such training categories as OJT, ancillary training, war skills training, and cross-utilization training.

2. Provide a means of producing training resource availability, utilization, and cost data to OJT managers and others concerned with the analysis of the efficiency of training.

3. Provide cost accounting and reporting in terms of trainee costs and total cost, by squadron/unit and base, and by Air Force Specialty across Major Commands.

4. Provide data for the development of Air Force Specialty cost indices which reflect the efficiency of unit training programs.

5. Provide a capability to make training cost comparisons between similar squadrons/ units.

6. Provide analyses of the cost data generated by the system to determine the efficiency of all training conducted at the base level.

7. Provide information for the justification for procurement of training resources required to accomplish training at the base level.

8. Provide cost analyses for use in forecasting resource requirements in support of budgetary decision making and projections of training requirements.

9. Provide analyses of information related to training resource availability, task training difficulty, task proficiency and the quantity and quality of training for use in determining OJT capacity for specific Air Force Specialties filling various positions in operational units and squadrons.

10. Provide analyses of information for MAJCOM and Air Staff training managers related to training resource availability and utilization, and the specific numbers of airmen qualified to train specific tasks, for use in computing OJT capability in units and squadrons.

11. Provide analyses of the efficiency of the scheduling process considering forecasts of training to be accomplished during a period, training accomplished, frequency of revision, etc.

12. Provide a means of identifying commonalities in tasks and/or positions in order to establish a job rotation policy that would provide cost benefits and other efficiencies to the Air Force with minimum impact on mission capability.

13. Provide management for an incentive awards program which recognizes the benefit to the Air Force of achieving training cost efficiencies.

14. Provide the capability to simulate or model the Air Force OJT system for the purpose of projecting the costs associated with making training pipeline modifications, changing missions, changing training loads, and/or revising other training, personnel, and classification policies.

TABLE 4. REQUIREMENTS FOR AN EFFECTIVE OJT SYSTEM (Cont'd.)

N. Management Information Interfaces

1. Provide data concerning training requirements completed, certification, decertification, and recertification to the Maintenance Personnel subsystem of the MMICS data system.

2. Provide for an exchange of information with aircraft and missile maintenance quality control, and other production quality control organizations, for the purpose of identifying procedural deficiencies in the specifications for task performance.

3. Provide information related to an airman's current position qualification, and his/ her current AFS development to the Air Force Personnel Data System as required in support of promotion policy, assignment policy, classification policy, and other career development policies.

4. Provide a means to produce data related to those tasks being trained on the job by various categories (such as AF specialty, position, pay grade, weapon system, task commonality across AFS, organizational component, etc.) for occupational analysis.

5. Provide a means to produce data that represent the training accomplished within the OJT system for an Air Force Specialty in order that the total training requirements of the specialty may be analyzed for the development of the STS.

III. ITS DESIGN ALTERNATIVES/FEASIBILITY ANALYSIS

Description of the Alternatives

The requirements for an effective OJT system as defined in Table 4 provided the basis for configuring three different ITS design alternatives for consideration in the Trade Studies Analysis during Phase II of this effort. The ITS functional model that resulted from the requirements definition process is shown in Figure 3.

Five major processes that must be accomplished in order to conduct job-site training are summarized in Figure 4. While each system requirement defined in Table 4 is applicable to one or more of these five processes, many of the requirements are not essential to meet the "minimum" requirements of an effective OJT system. However, they are needed for the system to attain maximum benefits. These minimum requirements have been grouped in Table 5 by their relationship to the five processes identified in Figure 4. Given enough manpower and sufficient management controls, an effective OJT system could be designed to satisfy these requirements without any computer support or automation, and the resulting system would offer considerable improvement over the current Air Force OJT system. On the other hand, many of the OJT deficiencies cited earlier could not be resolved by addressing only these minimum requirements.

Data requirements are implicit in the need to provide better methods for identifying and updating specific training requirements, to provide more frequent and valid proficiency evaluation, and to provide better methods for determining OJT cost and capacity. There is a fundamental requirement to standardize the data elements needed for solving such problems and to collect timely data for analysis and program evaluation purposes. These two major OJT requirements, data standardization and timely data collection, indicated that data automation should be considered for ongoing support of the ITS system and should become a part of the design of the three alternative system configurations for the ITS trade studies.

Another major consideration in the design of a more effective OJT system was that responsibility for all aspects of job-site training should reside within a management structure organized to ensure that the system requirements are met in a timely and efficient manner. Depending on the level of computer support, responsibility for accomplishing the minimum requirements identified would most probably reside within different functional areas on the base. In describing alternative approaches to configuring the ITS, it is important to keep in mind that Air Force functional responsibility for carrying out these minimum (and related) requirements shifts across functional areas with each alternative, depending on the functions automated in that alternative.

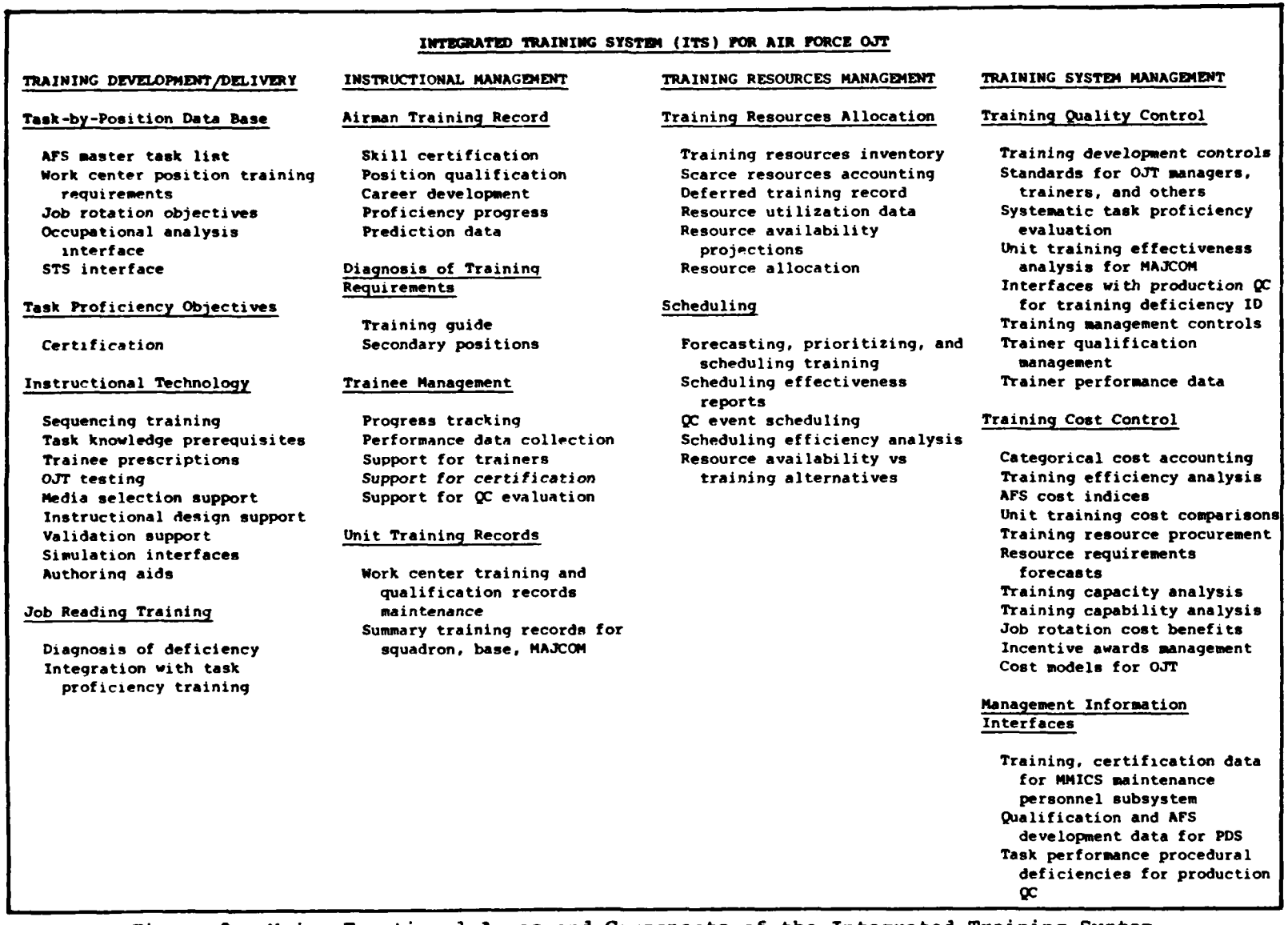

Figure 3. Major Functional Areas and Components of the Integrated Training System

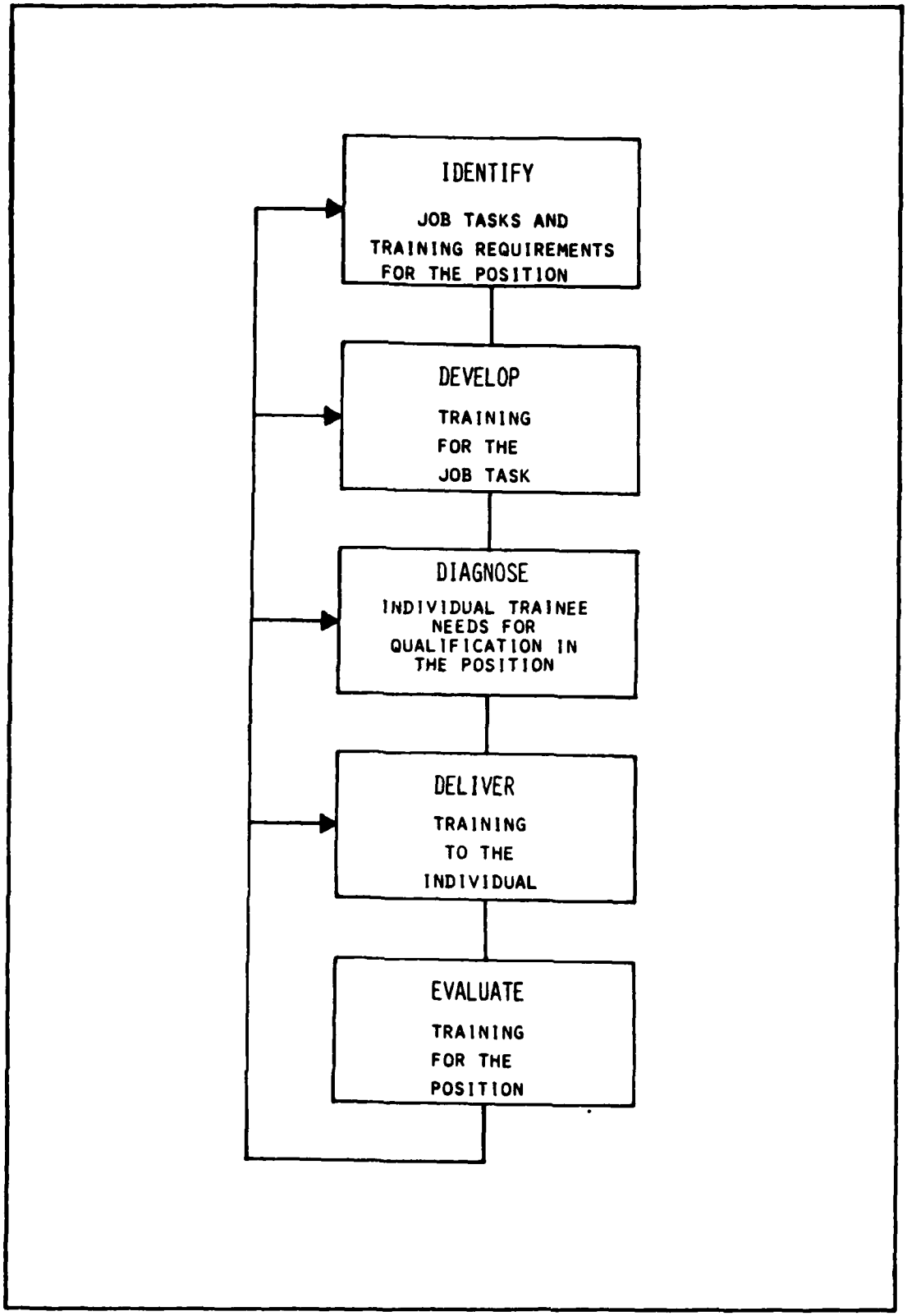

Figure 4. Five Processes Required for Effective Job-Site Training

TABLE 5. MINIMUM REQUIREMENTS FOR AN EFFECTIVE OJT SYSTEM

Process Function	Minimum Requirements from Table 4
Identify Job Tasks for Position	A3, B1, L11
Develop Training for the Job Task	L2, L3
Develop learning objectives and tests	C8, C19, C20, D1
Sequence learning activities	C1, C2, C4, C11
Develop instruction	C3, C6, C8
Determine resource requirements	C6
Diagnose Individual Training Requirements	A8, C9, G1, G2
Deliver Training to the Individual	
Sequence/assign job tasks	H1, H2
Assign learning activities	C1, C2, C5, C12, H3, H11, H12
Evaluate trainee skill/knowledge achievement	H4, H5, H8, H10, H11, H12
Provide feedback	C3, H11, H12
Track trainee progress	F5, F8, H9
Evaluate task proficiency	B2, F3, F4
Evaluate Training for the Position	J8, K6, L1, L4, L5, L13, L14, L15, L16

Alternative Design Considerations

Three factors were held constant across all three alternative ITS design approaches:

- Each alternative had to satisfy all of the minimum requirements for an effective OJT system.
- Each job task identified as a training requirement in the system would be defined at the same level of specificity with the same performance standard(s) in each alternative.
- The basic procedure for task proficiency evaluation would be the same in each alternative and would vary only in the types and level of support provided through data automation.

Several other factors were varied in developing the three alternative ITS design approaches:

- The approach to standardizing job task descriptions and/or training requirements for each Air Force specialty.
- The extent of development of job task instructional materials.
- The type of instructional management support to be provided to the trainee/trainer/supervisor.
- The level at which trainee performance data would be collected.
- The capability to manage the training resources required in support of job task training.
- The amount of data and level of detail at which data would be collected for assessing system performance.
- The extent of data automation to be provided.

General Description

During the initial phase of this effort, information was gathered which led to the definition of system requirements for the ITS and to the conceptual design of three alternative ways in which the ITS could provide data automation support for Air Force OJT. During the second phase of the effort, the alternative ITS design options were further refined to permit analysis of costs and benefits of each design alternative. All three of the ITS alternatives were designed to meet the minimum requirements for system effectiveness, which were oriented toward providing a large measure of responsiveness to mission requirements. The differences between the alternatives were mainly in the levels of support which the ITS could provide to relieve training managers and others of the burdens of the OJT administrative workload, and in the type of capability the ITS would include to provide accurate, timely measurement and assessment of system effectiveness.

The following system configuration alternatives resulted from consideration of the above factors:

Alternative 1. This approach would maximize the use of existing resources to establish the system and begin operations. Data automation would be restricted to those minimum requirements absolutely essential for an effective OJT system. Data collected related to training events and quality control evaluation would be limited and would be entered into the system at one of five designated collection points on a typical base. The potential for evaluation of overall OJT system effectiveness and efficiency would be minimal, requiring extensive manual effort for producing summary reports. Cost effectiveness data related to resources, scheduling and other critical components would not be

available in an automated form. Scheduling and resource allocation would be done manually. Alternative 1 characteristics are summarized as follows:

- o The use of existing instructional material resources would be maximized.
- o Data automation would be restricted to minimum essential requirements.
- o Limited job site training data would be collected at five locations per typical base.
- o Manual effort would be required to assess system effectiveness.
- o Manual scheduling and resource allocation functions would be required.

Alternative 2. This approach would incorporate modifications and improvements to the current OJT system that must occur in order to realize significant gains in satisfying the broader requirements for an effective OJT system. Under this approach, such improvements would be addressed by placing more emphasis on developing and redesigning training materials tailored to the specific requirements of training the task on the job and by providing a better capability to evaluate the effectiveness and efficiency of the OJT system. This latter improvement would require that appropriate data be collected during each training event and also during the quality control evaluation process to be utilized in training management, program evaluation, and program assessment. Data automation would be provided to support instructional management and data collection for these functions at one of 20 designated collection points on a typical base, located as close as practicable to the major concentrations of training being accomplished in the work areas. Some data automation support would also be provided for scheduling and allocation of training resources. Several standard computer reports would be produced concerning OJT effectiveness and efficiency. Alternative 2 characteristics are summarized as follows:

- o There would be a greater quantity of new and redesigned job-site instructional materials.
- o Data automation would be increased for most functions.
- o Support for instructional management and data collection would be increased to 20 locations per typical base.
- o There would be some standard computer reports of OJT effectiveness and efficiency.

Alternative 3. This approach would attempt to satisfy as many of the defined requirements for an effective OJT system as possible by utilizing the full capabilities of computer technology where feasible.

Research would be performed to develop new computer-based methodologies to use existing occupational survey and other task data for defining Air Force specialty training requirements for OJT and to develop new task analytic techniques for computer-supported generation of position training requirements, OJT development priorities, and AFS master task lists. Extensive effort would be devoted to developing training materials for a majority of the job tasks identified as position training requirements. Multi-media and/or computer-based instructional materials would be utilized where appropriate. Data would be collected on elements of each training event for instructional management and OJT program assessment purposes. Detailed performance and time data would be recorded for each training event as the training occurs, with a minimum of 75 designated data entry points on a typical base. A variety of computer reports would be produced on a regular basis and an ad hoc report generation capability would be provided for inquiries of ITS data bases for unique requirements. An automated resource allocation and dynamic scheduling capability would be incorporated for planning, management, and evaluation purposes. Alternative 3 characteristics are summarized as follows:

- Full computer support of all functional requirements, including job-site training delivery, would be provided.
- A large-scale training design and development effort would be involved.
- Detailed training data would be collected when and where training occurs at up to 75 locations per typical base.
- Enhanced OJT reporting and information retrieval capabilities would be included.
- Automated scheduling and resources allocation would be incoporated for OJT management.

ITS Trade Studies Analysis

A series of trade studies were performed during the second phase of this effort. Information from these studies was used in a trade study of the three alternative system design configurations in order to recommend an ITS option that would best meet the needs of the Air Force in the support of on-the-job training. The emphasis in the trade studies was to develop estimates for comparison purposes across a variety of system alternatives, rather than to analyze "final" decisions related to the ultimate system design or capabilities of the ITS.

To facilitate making reliable comparisons of the total costs of the ITS alternative design options, a "typical base" had to be defined in terms of estimates of population, numbers of squadrons/units, numbers of work centers/sections, tasks to be trained, and other estimated values which could then be extrapolated Air Force-wide. It should be recognized that the "typical" estimates used were, of necessity, derived values, and that they were made only for the purpose of comparison of the ITS alternatives themselves.

The approach taken in estimating the total cost of each ITS alternative included the following steps:

- Segmentation of base-level, Air Force specialty, and Air Force-wide costs into the five major OJT process functions, and the ITS program management and computer support functions.
- Calculation of the estimated costs of ITS-supported OJT on a typical base.
- Extrapolation of the estimated base-level costs Air Force-wide.
- Determination of the discounted annual life cycle costs for each alternative ITS configuration.

The projected costs for each ITS alternative were developed by first estimating the number of manhours required to support each of the requirements for an effective OJT system. Labor costs were calculated by multiplying the estimated manhours for a specified requirement by the standard composite rate for the pay grade as defined in AFR 173-13, USAF Cost and Planning Factors Regulation. Equipment costs were calculated by averaging data obtained from computer industry sources for similar equipment. Computer support costs for personnel, equipment, and software were also developed for each alternative. Appendix B provides a description of the process utilized to develop computer support costs, and the results of the computer support trade studies analysis.

The detailed cost estimates for each alternative at a typical base were then categorized by major ITS processing function for both investment costs and recurring operational costs. Investment costs are those one-time costs which are incurred to develop and implement the system, such as purchase of computer equipment, development of computer programs, and establishing the master task list. Recurring operations costs are those annual costs which are incurred repetitively over the life cycle of the system, such as man-hours expended for OJT quality control and computer operations. ITS program management costs include all costs that could not be directly allocated to one of the OJT process functions or the computer support function, such as scheduling, effectiveness and efficiency analysis, unit training effectiveness assessment, and capability and capacity analysis.

The base level cost estimates were extrapolated to Air Force-wide estimates and included with other costs calculated at the total Air

Force level. In addition, estimated R&D costs for ITS Alternative 3 to develop a methodology to convert occupational survey data into OJT requirements and to develop new survey techniques which will result in the automatic generation of position training requirements, OJT development priorities, and AFS master task lists were included. The estimated costs Air Force-wide were developed for each ITS processing function by categories of R&D costs, investment costs, and recurring operational costs.

The total discounted costs for a projected life cycle of 20 years using a standard DOD discounting procedure were estimated to be as follows:

- ITS Alternative 1 - $1,198.20M
- ITS Alternative 2 - $ 777.82M
- ITS Alternative 3 - $ 670.85M.

Alternative 3 is seen to be the preferred alternative based on cost alone. This is primarily due to the trade-off between labor costs expended annually versus the cost of automation to replace functions accomplished manually. Alternatives 1 and 2 were estimated to require significantly lower investment costs for automation with greater use of Air Force personnel required annually throughout the life cycle of the system. On the other hand, Alternative 3 would require a greater capital investment in the early years to automate functions, thus reducing significantly the labor expended annually throughout the life cycle.

A comparison was also made of the benefits to be derived from the ITS alternatives relative to the requirements defined in Table 4. Each alternative's components were analyzed with respect to 14 areas of quantifiable output measures:

- Accuracy
- Availability
- Implementability
- Maintainability/ Controllability
- Manageability
- Morale
- Operating efficiency
- Production or productivity
- Quality
- Reliability
- Safety
- Security
- Time savings
- User acceptance.

The analysis indicated that ITS Alternative 3 would be capable of providing the greatest overall benefit to the Air Force through its life

cycle. The following beneficial interim products, which would be available for use in the operational environment prior to full-scale implementation, were also identified:

- o Air Force specialty task lists for OJT.
- o New occupational analysis techniques.
- o OJT development tracking aids.
- o Enhanced structure in OJT processes.
- o Trainer performance assessment measures.
- o New airman training record.
- o Quality control procedures for OJT.
- o New base-level training management organization.
- o Unit training effectiveness measures.

Also addressed in the trade studies were the technical, economic, and operational feasibility of all of the defined ITS alternatives. Since potential alternatives judged not technically feasible were discarded during the development of design options, the three ITS alternatives that were compared were considered to be technically feasible. In addition, for the purposes of comparing costs across alternatives, all appeared in varying degrees to be economically feasible. Operational feasibility was assessed in terms of the potential for success, and was judged to be high for all three design alternatives examined. Based on the results of the trade studies, ITS Alternative 3 was selected for further system definition and specification during the final phase of this effort. Two additional analyses focusing on Alternative 3 were also conducted and data provided to the Air Force. The first of these was a cost-benefit analysis to compare the present OJT program with the ITS Alternative 3 configuration. The second was an ITS development site alternatives analysis to examine the suitability of various Air Force bases proposed by the Major Commands for ITS development and demonstration.

IV. DEVELOPMENT OF ITS SYSTEM SPECIFICATIONS

General Discussion

As stated in section I, the primary purpose of this effort was to conduct a system definition study for preparation of a system specification that would enable the Air Force, in a subsequent effort, to develop and demonstrate a computer-based Integrated Training System. This system was to address requirements for the management, development, and evaluation of Air Force on-the-job training. This involved an iterative process illustrated in Figure 5 in which each phase of the project augmented or expanded the conceptual design of the ITS, leading to the development of a set of system specifications. Out of this process evolved key building blocks that became major controls for the ultimate design of the specifications.

When this effort was initiated, the Air Force provided an illustrative model which described major OJT problem areas and job-site training concepts that should be explored. During the initial phase, previous research and development (R&D) efforts related to problems in OJT were analyzed and the results incorporated into the field survey instruments and the improved model for management of task proficiency training that evolved from the base visits. From these sources and controls, requirements for an effective OJT system were derived.

In order to ensure that the system would be compatible with and meet the requirements of the Air Force and its OJT management organization, review and approval decision points for OJT functional managers were inserted at the completion of the requirements definition and the trade-off analysis phases, and during the preparation of the design specifications.

The key building blocks that became major controls for the design of the specifications were as follows:

- The general procedural model for management of task proficiency training (Figure B-6, Appendix B) that evolved from the initial illustrative model, the HQ USAF, MAJCOM, Separate Operating Agency (SOA), and base visits, and the review of previous R&D for OJT became the source of many of the system functional requirements. This model also provided a basis for analyzing each ITS configuration alternative and defining ITS data requirements.

- The requirements for an effective OJT system (Table 4) defined the functional controls for the system and its corresponding data requirements.

- The minimum requirements (Table 5) established a major control for each alternative design option analyzed in the trade-off analyses.

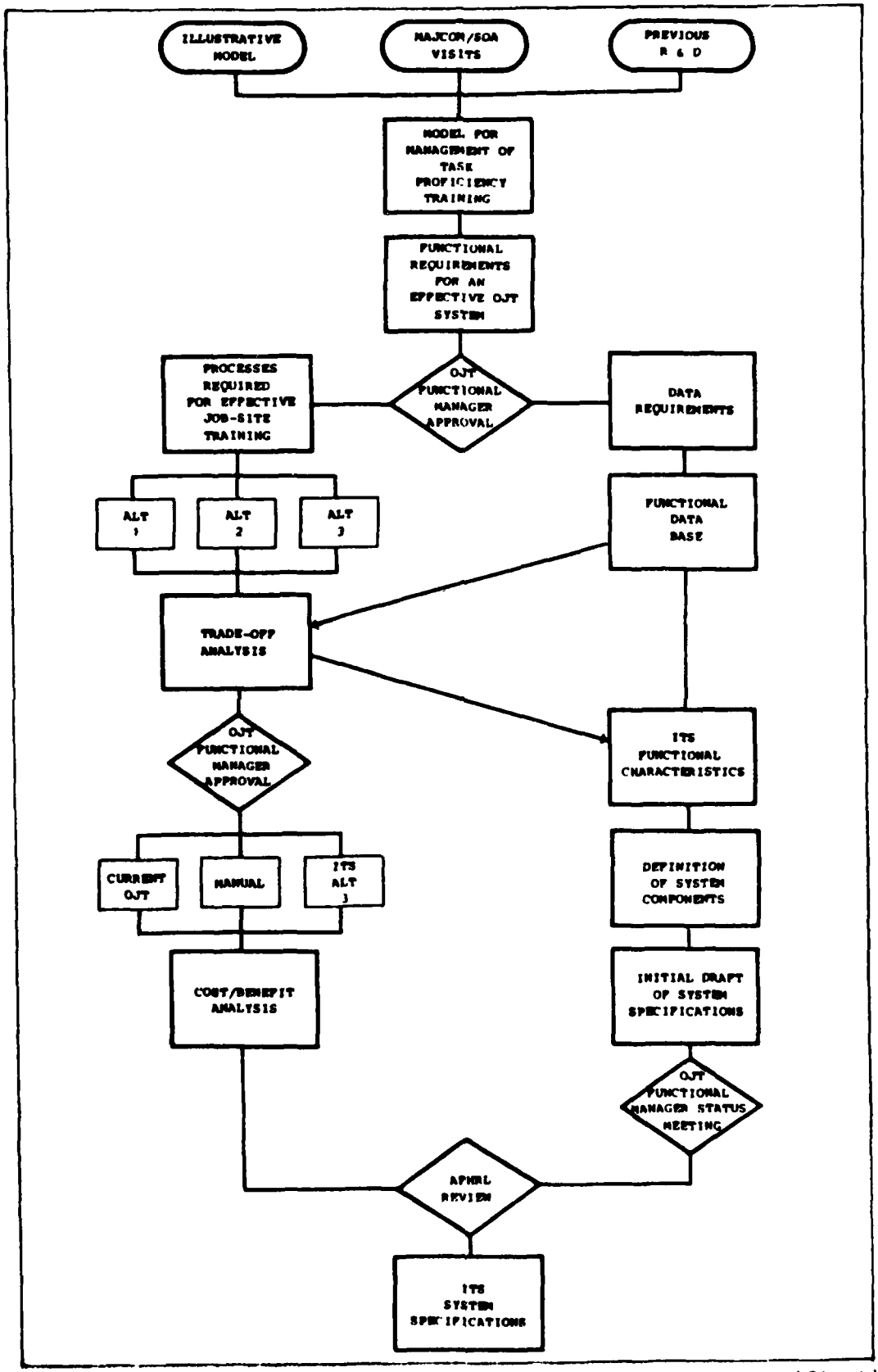

Figure 5. Iterative Process for Development of ITS System Specifications

- The functional data base that resulted from organizing data requirements into major functions to be supported by ITS provided the basis for estimates used in the trade-off analyses. This, coupled with the preferred ITS design alternative (Alternative 3), provided essential controls for the description of the ITS functional characteristics.

As a result of the analyses and design accomplished throughout the process described in Figure 5, it was determined that the ITS to support on-the-job training should be designed to address the following objectives:

- Increase individual and unit performance to enable the Air Force to improve combat readiness.
- Redirect the emphasis in Air Force on-the-job training away from general career development and toward job qualification.
- Utilize more efficient methods of identifying the training requirements for airmen to become fully qualified in their duty positions.
- Implement new techniques for performing valid, standardized, and more frequent task proficiency evaluations, and for assessing unit training effectiveness to ensure that training quality control is maintained.
- Support new methodologies for determining OJT cost and unit capacity to conduct job-site training.
- Support new technology in the delivery aspects of job-site training, thereby increasing proficiency with no significant increase in training time.
- Redirect the activities of training technicians (AFSC 751X2) away from current administrative duties, toward duties and responsibilities related to training evaluation and the application of a valid training methodology.
- Simplify the administration of OJT.

ITS System Description

System Overview

The Integrated Training System is a computer-based system that will provide support, at all levels of management, of Air Force OJT in the following functional areas (see Figure 6).

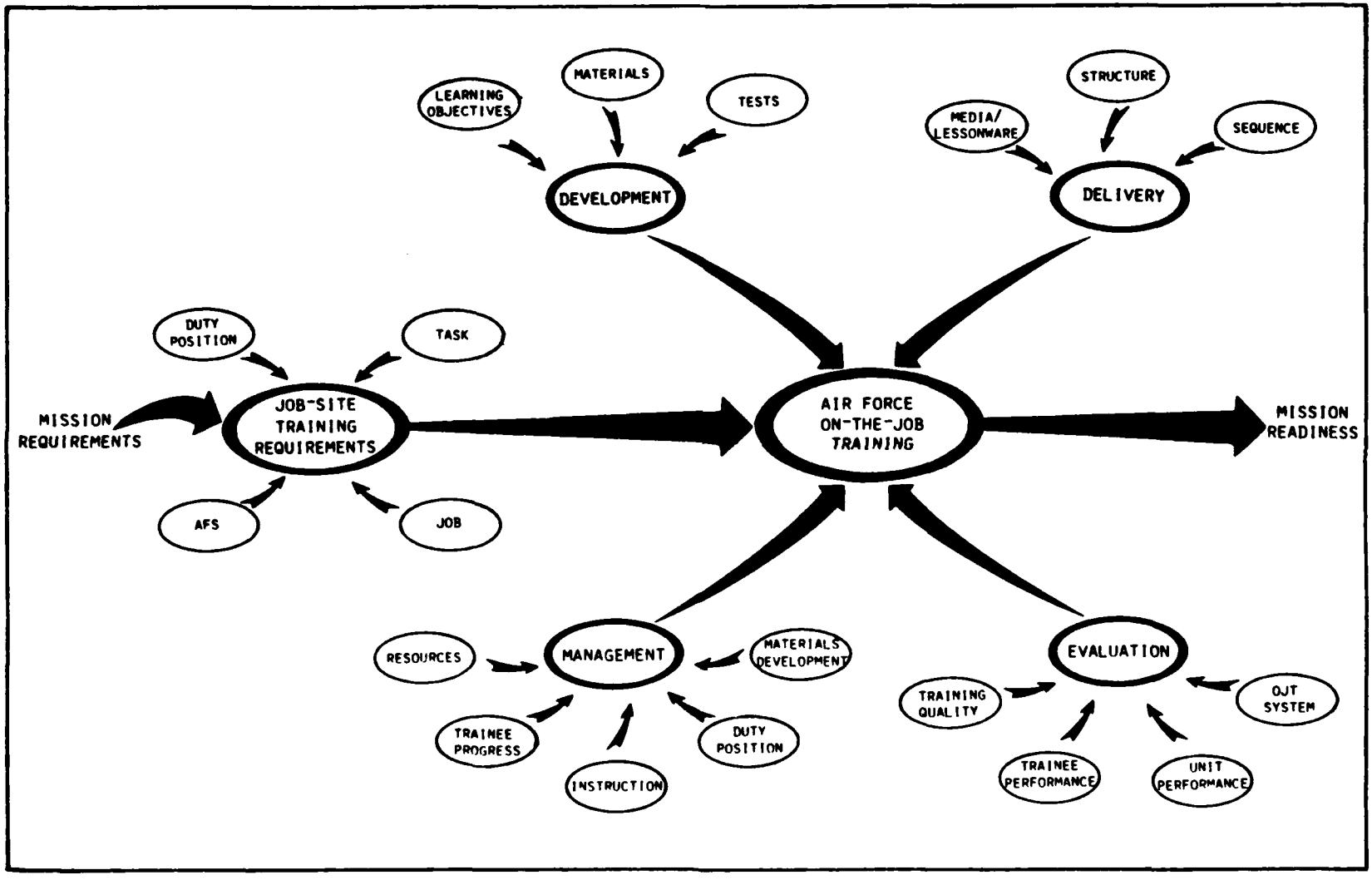

Figure 6. Functional Relationships within the Integrated Training System (ITS)

- Job-Site Training Requirements: This functional area of ITS addresses defining the training required to translate the requirements of the mission into unit/squadron mission readiness, and includes Air Force specialty training requirements by job, duty position, and task.

- Development: This functional area pertains to the production of all training materials that provide the knowledge and skills needed for full qualification in a duty position.

- Delivery: Instructional delivery is the means by which the use of training materials can be controlled to result in a predictable outcome; i.e., task proficiency.

- Management: The management aspects of ITS address training resources utilization, trainee progress tracking, instructional management, duty position qualification, and management of the training development processes.

- Evaluation: This functional area encompasses the assessment and control of the cost effectiveness of job-site training and the system which supports it.

Each of these functional areas was examined in depth to provide an analysis of requirements for an effective Air Force OJT system (Table 4). The analysis also identified major training and training management processes to be performed and the general information requirements in support of these processes. The information requirements were organized in terms of an ITS functional data base that evolved during the project and corresponding groups of requirements that must be supported for an effective OJT system (see Figure 7). Each ITS functional data base was defined as follows:

- Master Task List (MTL): Contains all job tasks for each specialty within the Air Force. It would be utilized to standardize the identification of all job tasks and provide a unique description of each task for universal use throughout the Air Force.

- Position Training Requirements (PTR): Contains the identification of each position in a work center/section and each job task on the master task list that is applicable to that position. It would be used to identify the training requirements for each position and to provide a basis for generating an accurate diagnosis of the training required for an individual airman.

- Master Instructional Management/Delivery Control (MIMDC): For each job task identified in the MTL, the MIMDC contains a detailed description of each step in the training process required to meet task proficiency objectives. It also includes the controls essential for proper sequencing of the training

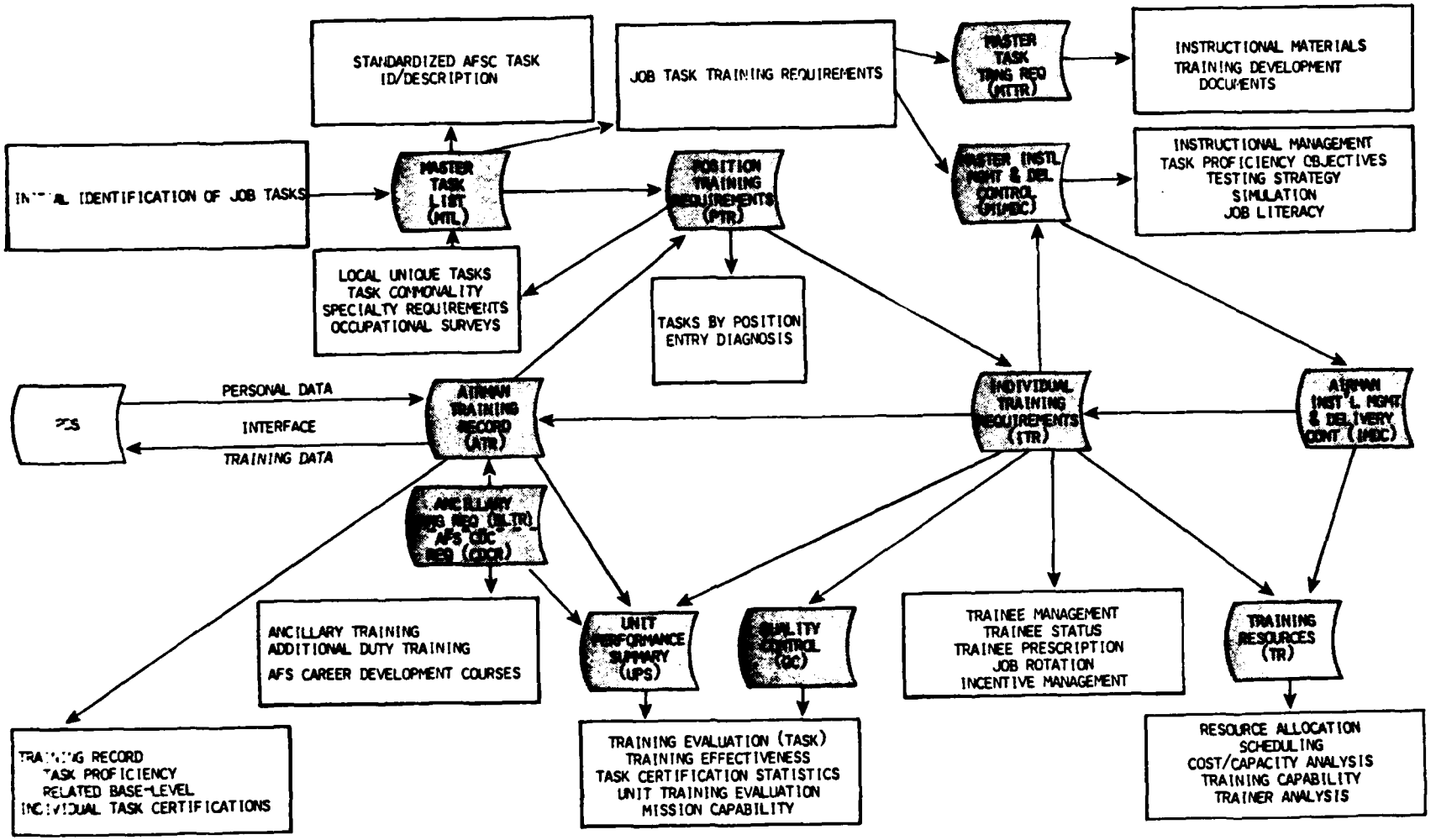

Figure 7. ITS Functional Data Base

and for the collection of historical data required to measure trainee progress and management. It would be the basis for directing and controlling all of the learning activities of each trainee. Once a task training requirement was defined and entered in this data base, it would be available for use throughout the Air Force by all units providing training in that job task.

- Airman Training Record (ATR): Contains a historical account of all training completed by each airman in the Air Force. Included would be information related to resident technical schools training, job task proficiency training, ancillary training, WARSKIL training, cross-utilization training, and other base-level training. This record would be forwarded to each base of assignment throughout an airman's career and would be the basis for diagnosing individual training requirements for the airman and for providing various summaries of unit training performance and status.

- Individual Training Requirements (ITR): Contains a detailed account of the job task training required for an airman in his/her assigned duty position once the training needs diagnosis has been accomplished. It would be used to provide general training status and control trainee management functions while an airman is assigned to a duty position and would be closed out upon reassignment to another position or base.

- Airman Instructional Management/Delivery Control (IMDC): When a job task is assigned to an airman for training, the task training requirements for that task would be located in the MIMDC and linked to a separate data file for that airman. It would be used to direct and control the learning activities of a specific trainee and to provide information concerning these activities to his/her trainer and/or immediate supervisor.

- Training Resources (TR): Contains a detailed account of the training resources required to provide job qualification for every position on a base and those required to conduct other base-level training. It would be the basis for the system to schedule and allocate resources and to provide the data for analysis and monitoring of OJT costs, capacity, and capability.

- Quality Control (QC): Contains a record for each job task and the identification of the individual airman for whom certification to perform the job task has been completed. It would be the basis for selecting job tasks for the external evaluation/quality control requirements of job-site training.

- Unit Performance Summary (UPS): Contains a summary of the task certifications that have occurred and all training events completed within a given work center/section during specified

time intervals. This would provide the basis for analyzing training effectiveness in relation to mission priorities.

- Master Task Training Requirements (MTTR): Contains a detailed description of each job task for each AFS, the status and progress of development of all instructional materials and related documents, controls, and tools for building the MIMDC data base, and a catalog of all materials related to the training of a task.

- Base Level Training Requirements (BLTR): Contains the identification of each ancillary training course and other training events not related to an AFS. It would be used to identify the non-AFS training requirements for an airman while assigned to an Air Force base.

- Career Development Course Requirements (CDCR): Contains the identification requirements and controls for each Career Development Course in the Air Force. It would be used to identify CDC requirements for an airman while assigned to an Air Force base.

The identification of components of each major functional area of OJT and their support requirements were the result of analyzing OJT subfunctions, processes, and their associated information and data flow requirements. ITS subsystems were defined that represent the distribution of the components into manageable subsystems, described briefly as follows:

- OJT Management Subsystem: Provides a means to identify the training required for full qualification in every duty position in the Air Force, a means to monitor and control the progress of individual trainees toward such qualification and other Air Force base-level training requirements, and to simplify OJT administration.

- OJT Development and Delivery Subsystem: Provides a means to produce the materials and media which will develop in trainees at the job site the knowledge and skills required for full qualification in a duty position, and a means to deliver all instruction specified for certification on a job task.

- OJT Evaluation Subsystem: Provides a means to evaluate the efficiency and effectiveness of the Air Force OJT system, and ensure that training quality and cost control are maintained.

- Computer Support Subsystem: Provides data automation support for all functional areas of the Air Force OJT system.

- Personnel and Support Subsystem: Provides a means to identify and qualify personnel who will manage, supervise, and operate the ITS and personnel who will develop and conduct OJT, as

well as the means to provide logistics and maintenance support for system operation.

The relationships between Air Force mission requirements, job-site training, and the ITS are illustrated in Figure 8.

ITS Functional Characteristics

Each of the ITS subsystems was organized into functional components as illustrated in the ITS specification tree in Figure 9. Major functions that would be supported by the ITS are also illustrated. A general description of each component and the functional data bases required to support each are provided in the following sections.

OJT Management Subsystem. The OJT management subsystem of the ITS would provide a means to (a) identify Air Force specialty (AFS), duty position, ancillary and related base-level training requirements, (b) manage airman training progress toward task proficiency and full qualification in a duty position, and (c) manage the allocation of base training resources and the scheduling of training. The components of the OJT management subsystem and their major functions are

- o Training Requirements Management Component
  - AFS master task list (MTL).
  - AFS performance requirements.
  - AFS training requirements.
  - Position training requirements (PTR).
  - Ancillary/additional duty training requirements.
  - AFS career development course (CDC) requirements.
  - Master task training requirements (MTTR).
- o Airman Training Management Component
  - Airman training record (ATR).
  - Training control identification.
  - Training needs diagnosis.
  - Individual training requirements (ITR).
  - Training progress management.
- o Training Resources Management Component
  - Inventory establishment.
  - Training scheduling.
  - Training resources allocation.
  - Resources availability monitoring.

a. Training Requirements Management Component. The training requirements management component of the OJT management subsystem provides identification and specification of all performance and training requirements of the Air Force specialties identified for

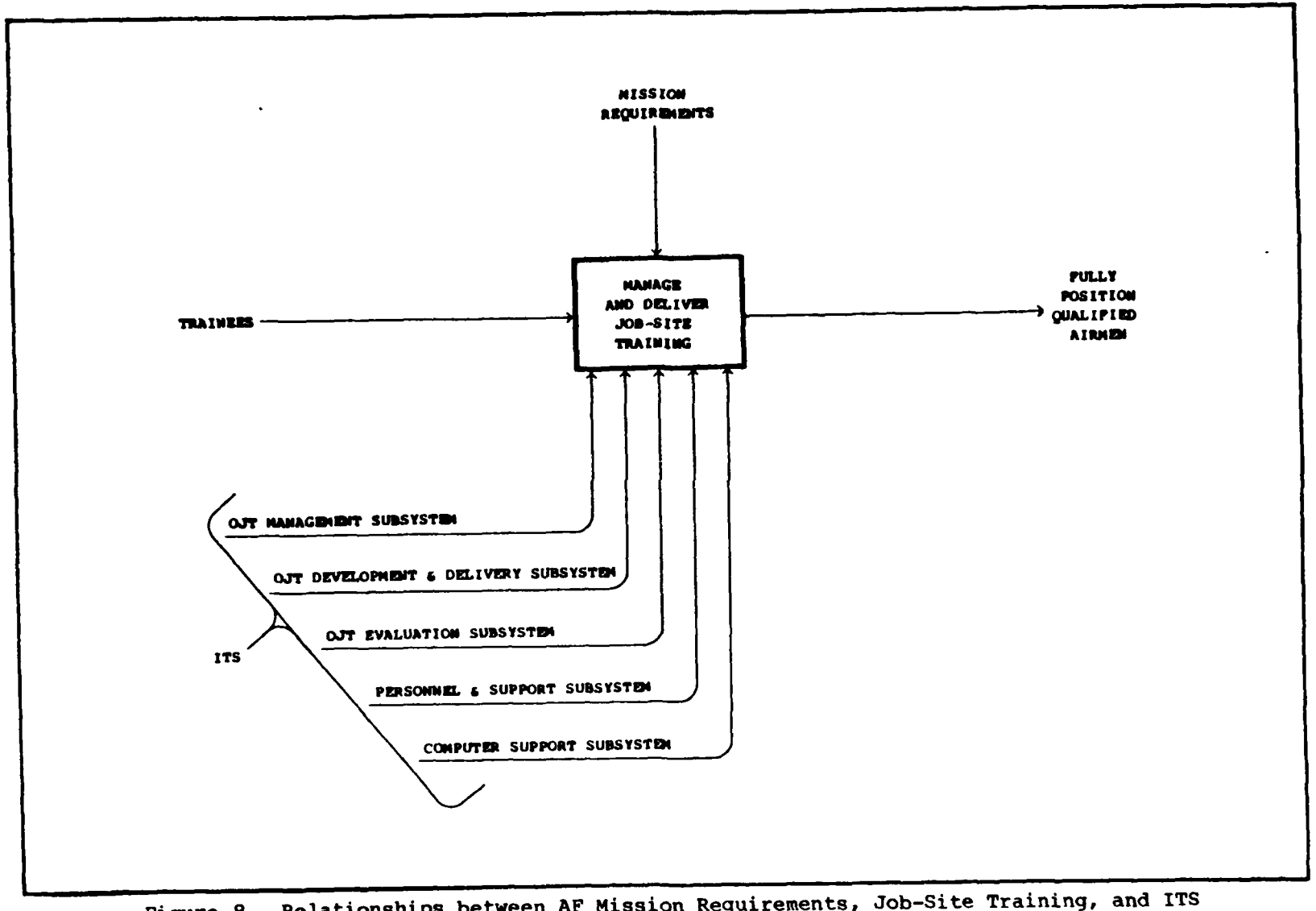

Figure 8. Relationships between AF Mission Requirements, Job-Site Training, and ITS

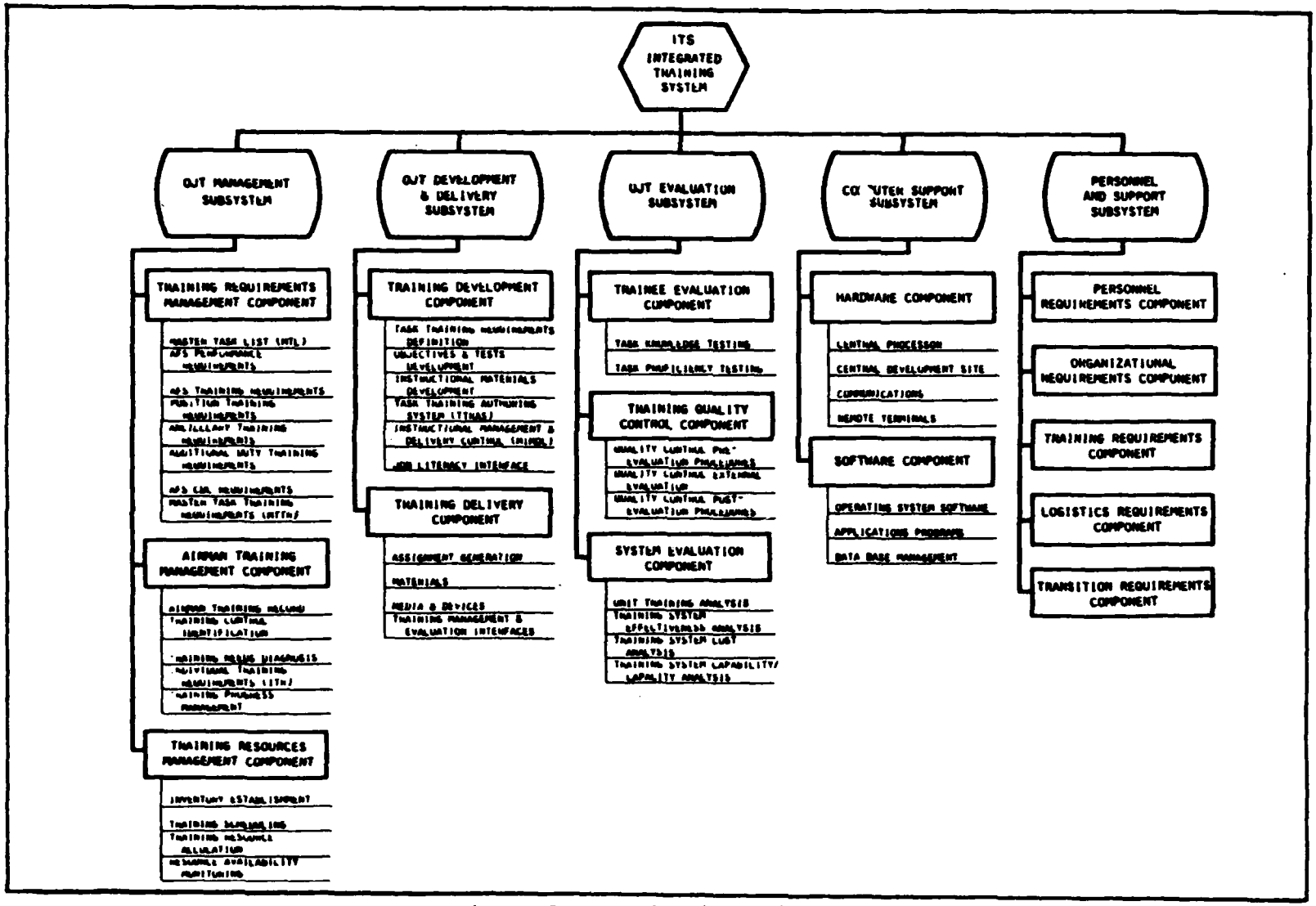

Figure 9. ITS Specification Tree

inclusion in the ITS development and demonstration program. In addition, this component provides identification of all ancillary, and other base-level-conducted training required by personnel assigned to the ITS development and demonstration base who hold any of the designated Air Force specialty codes. The data produced by the functions that comprise this component will also provide the necessary foundation data for diagnosing individual training requirements, monitoring individual training progress, developing OJT instructional materials, and evaluating individual task proficiency and training system effectiveness.

The functional data bases incorporated to support the operation of this component of ITS are the Air Force master task list (MTL), master task training requirements (MTTR), generic and operational position training requirements (PTR), base-level training requirements (BLTR), and AFS CDC requirements (CDCR). The ITS includes the capability to allocate resources for, schedule entry into, and monitor completion of training events associated with ancillary and other base-level training requirements, including CDCs. The training requirements in these areas are adequately identified and specified by current Air Force and MAJCOM/SOA policies. Task performance and training requirements related to assigned duty positions within Air Force specialties are, however, not adequately identified and specified by current policies. This has resulted in marked deficiencies in defining measures of OJT effectiveness, obtaining task proficiency training and certification standardization, and managing individual progress toward duty position qualification. These deficiencies would be corrected through the development and demonstration of the methodologies and supporting program software necessary to create the functional data bases associated with this component of the ITS OJT management subsystem.

- A master task list for each Air Force specialty identified for inclusion in the ITS development and demonstration program. The master task list should be derived insofar as possible from existing Air Force sources containing task identification and performance data. Each task identified on the master task list must be described at a level of specificity sufficient for individualized task proficiency training and performance certification.

- Position training requirements (PTRs), both generic and operational, for each duty position or job performed in work centers identified for inclusion in the ITS development and demonstration program. These are intended to be generated from the Air Force master task list when practicable. The generic PTR lists those tasks, drawn from the master task list, that represent generic duty positions within an Air Force specialty. The generic PTR must be capable of being transformed into an operational PTR that lists the tasks actually performed in the development site work centers.

- Base-level training requirements (BLTR) for all personnel possessing the designated AFSs who are assigned to the development work centers. The base-level training requirements functional data base identifies all Air Force and MAJCOM/SOA-directed ancillary, and other base-level-conducted, non-specialty-related training requirements. These requirements will be identified by a system of standardized Air Force course identification numbers, and the requirements description should include at a minimum the course number, title, and renewal requirements data. The base-level training requirements list will group requirements based on common relationships such as, but not limited to, base and unit of assignment, Air Force specialty, pay grade, and assigned duty position.

- Career development course requirements (CDCR) for all designated Air Force specialties authorized within the work centers. These requirements can be identified and extracted from current Air Force Extension Course Institute documentation, and must reflect current CDC requirements by skill level within the designated Air Force specialties.

- Master task training requirements (MTTR) data base containing a detailed description of each task contained on the master task list (MTL) for each Air Force specialty included in the ITS development and demonstration program. The MTTR should contain a complete description of each MTL task to provide a means of managing the status and progress of all training development activities related to the task and to the specialty. The MTTR should be designed to accept data in an iterative fashion from all ITS functions involved in the identification, specification, definition, development, and delivery of Air Force task-specific training. The description of each task in the MTTR should include at least a job task identification code, the task title, the weapon system/equipment/functional area, prerequisite task(s) or sub-task(s), performance specifications and proficiency requirements, data source references, training resource and job literacy requirements, performance/learning objectives, and task knowledge and proficiency test items. Task performance and proficiency data could be generated and collected in a format compatible with the unified data base (UDB) or other appropriate data bases. The MTTR would also identify the agency having development responsibility and provide a means by which to establish, assign, and monitor the status of production milestones related to training development activities. The MTTR can also provide a directory service identifying all Air Force and other Department of Defense (DOD) agency users of ITS training development products.

b. Airman Training Management Component. The airman training management component encompasses the functions of

- o Airman training record (ATR).
- o Training control identification.
- o Training needs diagnosis.
- o Individual training requirements (ITR).
- o Training progress management.

These functions provide for (a) the identification of a duty position to which an individual airman has been assigned, (b) a diagnosis of the training required for that airman to become fully qualified in that position, and (c) the control of the job/task assignments necessary to ensure that each training requirement has been assigned, certified, and entered in the ATR.

The airman training record function is intended to provide a complete record of all training received by an airman during his/her Air Force career. The training record must be maintained in a manner that will permit other system components and/or authorized Air Force personnel to determine accurately which job tasks an airman is certified to perform, as well as to diagnose the training needs for the airman with respect to a duty position. It is a permanent record of training that would "flow" with the airman from base to base throughout his/her career in the Air Force. Information that is required to be maintained is as follows:

- o Personal data from the airman PDS record: Social Security Account Number (SSAN), name, rank, date of birth, PDS record identifier, basic airman data, education/qualification data, Armed Services Vocational Aptitude Battery (ASVAB) scores, job literacy score, job information data, duty status, AFSC data, etc.
- o Formal training data: the standardized course identification (ID) and date completed, etc. for each resident technical course or FTD course successfully completed.
- o Ancillary training data: the standardized ID and date last completed, etc. for each ancillary training event completed.
- o Generic position data: the generic position ID, dates held, and indication of full position qualification, etc. for each position held during the airman's career.
- o Job task data: the job task ID, current task certification status, date of last certification, organizational ID for the unit of last certification, and the unit where training was

accomplished, SSAN for the trainer of record, and certifying official of record, etc. for each job task in which the airman is or once was certified to perform.

- Trainer qualification data: the job task ID, date of trainer certification, and organizational ID of unit where certification was achieved, etc. for each job task on which the airman is certified to train others.

- CDC data: the CDC number, date assigned, date completed, etc.

A major function of the ITS is to maintain and control the progress of each airman towards full position qualification. This cannot be accomplished without establishing and maintaining an accurate account of individual training requirements (ITR) for that individual and the status of the individual on each job task recorded in the ITR. The ITR is envisioned as an interim record which augments the ATR to provide a complete training record of both the training in progress and training completed for the airman.

The ITR for each airman is designed to maintain an accurate account of the certification status of each job task recorded in the ITR. The following task training status conditions have been identified as minimum requirements to be maintained within this ITR function:

- Task not trained.
- Task previously certified at different base.
- Task previously certified at present base.
- Task knowledge training in process.
- Practical task training in process.
- Training completed but not certified.
- Task certified in current position.
- Task certification expired.
- Task recertified in this position.
- Task recommended for decertification.
- Task decertified.
- QC followup action in progress.

Another major function of this component is to provide a means to manage all instructional activities and deliver all instruction required for certification on a job task and to provide access to all system

functions in support of certification, recertification, and the training quality control activities of the ITS. Six levels of control were identified within the system to provide an effective management scheme for each job task (see Figure 10). A general discussion of the relationship between each level of control within the system and its primary purpose follows:

- Individual training record control: The ITR itself would be the highest level of control within the system and would represent a collective description of all job tasks to be performed by the airman in an assigned duty position. The diagnosis function identifies the job tasks for which training is required. The task training certification status would be maintained at this level of control for each job task.

- Job task control: A current account of the certification status of each job task would be maintained within each ITR as the next level of control. As each job task is activated for training or for recertification/quality control evaluation, control of that job task would be transferred to the appropriate set of specifications as defined in the MIMDC.

- Task training assignment control: This level of control would establish the IMDC file for an airman for the job task activated. It would be used for (a) identifying common subtasks that could be bypassed within this job task that were completed successfully while in training for another job task, (b) assigning IMD modules (training, certification, recertification, quality control evaluation) in the sequence specified, and (c) communicating changes in training status to the training progress management function.

- Instructional management and delivery module control: An IMD module is defined as a complete, self-contained set of instructional activities, tests, procedures, resource requirements, controls, etc. related to a training module. It could represent a subtask or a complete task if no subtasks had been identified. It could also relate to a task certification module, a recertification module, or a quality control evaluation module. IMD modules when combined would form the complete task training requirements for a job task. This control function is required for assigning instructional activities in the sequence specified and for providing notification of IMD module completions to task training assignment control.

- Instructional activity control: An instructional activity is defined as one of the essential steps in the task training process leading to task certification. These steps and the sequence of execution are (a) trainee meets criterion on knowledge prerequisites after completing study assignment, (b) trainer provides a demonstration of the task (optional),

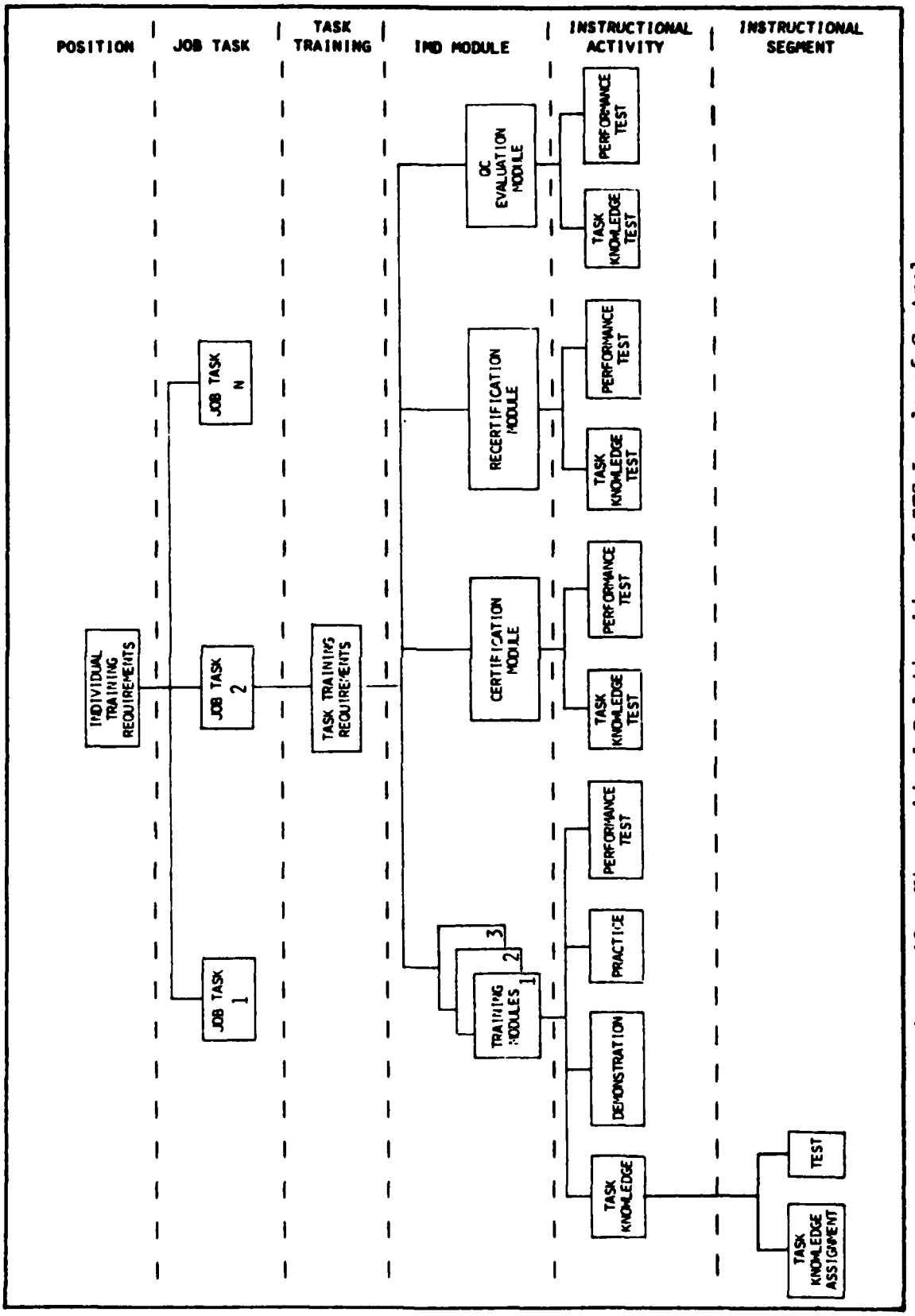

Figure 10. Hierarchical Relationships of ITS Levels of Control

(c) trainee practices the task, and (d) trainee performs task within specified proficiency standards.

- Instructional segment control: An instructional segment is defined as the smallest unit of a job task training process which contains all of the assignments necessary to achieve a particular training result.

In order for the system to achieve these functions, a detailed set of structured specifications related to all of the instructional activities required during the training process would need to be defined in a master instructional management and delivery control (MIMDC) data base. The controls described previously, as established in the MIMDC, would become the primary means for the system to manage and control the instructional process from the time that a job task is activated until certification/recertification is achieved by the airman or the quality control external evaluation function is completed. In addition, functions would be included to provide notification of training status to the training progress management function at appropriate checkpoints in the training process and to record all trainee performance data for use in the OJT evaluation subsystem. This would be accomplished by linking the task training requirements for a job task as established in the MIMDC to an individual airman when the job task is activated for training to provide a means to manage and control the job task training process to completion. This can be accomplished with an airman instructional management and delivery control (IMDC) data base for each job task consisting of the following three sections:

- Specifications section: Provides the detailed instructions and specifications for training the job task as extracted from the master instructional management and delivery control (MIMDC).

- Control section: Provides the control information needed to reflect an accurate accounting of task training status, progress, time in training for each control category, outstanding assignments, etc.

- Performance section: Provides a record of each instructional assignment, response, disposition, etc. and summary data for each control level achieved.

c. Training Resources Management Component. The training resources management component was designed to provide a means to establish an inventory of training resources, to track the status of each resource, to schedule resources, and to generate usage data for training cost, capability, and capacity analysis. The following functions would be provided:

- Establish an inventory of all training resources on a base, including location, responsible organization, etc.

- o Maintain an inventory of qualified trainers for each job task trained on that base. Record data related to each trainer assignment for training and QC evaluation functions.

- o Maintain an inventory of scarce training resources that require allocation and tracking. Record data related to usage during allocations, non-availability, etc.

- o Process requests for allocation of resources.

- o Schedule training resources, ancillary/additional duty training events, certification/recertification actions, and training quality control evaluations.

- o Allocate testing devices and transfer control to the trainee evaluation component.

- o Allocate media and transfer control to the OJT delivery component.

- o Restore resources to "available for use" status when notified that the instructional activity or training event is completed.

- o Record changes in status due to non-availability conditions such as preventive maintenance, equipment up/down, etc.

OJT Development/Delivery Subsystem. The OJT development and delivery subsystem was designed to produce and maintain instructional materials to support job-site training. It would also provide the mechanisms necessary for managing the development and delivery of training materials to support task proficiency training and certification. The two components envisioned for this subsystem and the functions that comprise them are described in the following paragraphs.

a. Training Development Component: The training development component of this subsystem should, at a minimum, contain the following six functions:

- o Task training requirements definition.

- o Objectives and tests development.

- o Instructional materials development.

- o Task training authoring system.

- o Instructional management and delivery control.

- o Job literacy interface.

The training materials produced by this component would directly support job-site training by providing the means to train the task

skills and knowledge required for individual task proficiency and certification. Air Force instructional system development (ISD) policy could be operationalized in the job-site environment through the development and operation of these functions. Operationalization of the Air Force ISD process should, at a minimum, provide the capability to perform the following:

- Review knowledge, skill, proficiency, and job literacy requirements associated with each job task for which training will be developed.

- Catalog specific skill and knowledge performance/learning objectives essential to the development and maintenance of instructional materials and tests, so that requirements for revisions to, and improvement of, these materials can be readily identified.

- Develop effective and efficient instructional and testing strategies and transform them into specific instructions for the ITS master instructional management and delivery control (MIMDC) data base. These strategies would be used for making trainee assignments, evaluating trainee performance, and for gathering and reporting information related to trainee progress toward proficiency on a job task.

- Construct and catalog knowledge and skill test banks.

- Catalog, deliver, and formatively evaluate all instructional materials developed to support job-site training, including those which are designed solely to increase job literacy.

- Track OJT instructional materials development progress through the major process stages.

Development progress can be tracked through the master task training requirements (MTTR) function described earlier. Following the identification of the task and a determination that training on the task is required, a development agency would be designated and the identification and location of the agency would be entered in the MTTR. Estimates of the development manhours required for each development product or document would be made and inserted in the MTTR to provide a basis for determining the progress of the development effort.

b. Training Delivery Component. This component provides a means to assign all instructional activities and deliver all instruction specified for certification on a job task and to provide access to all system functions in support of certification, recertification, and the training quality control activities of ITS. In order for ITS to achieve this goal, a detailed set of structured specifications related to all of the instructional activities required during the training process would be defined in the master instructional management and delivery control (MIMDC) data base during the training development process. These

controls as established in the MIMDC then become the primary means for the system to manage and control the delivery process from the time that a job task is activated for training until certification/recertification is achieved by the airman or the quality control external evaluation function is completed. Major functions provided in this component include assignment generation, materials, media and devices, and interfaces with the training management and evaluation subsystems.

1. Assignment Generation - This function was designed to provide a controlling mechanism for initiating all instructional delivery activities that are performed within the system and to provide the necessary access controls that allow the trainee, trainer, and/or supervisor to communicate with the system during the training process. This function would also generate instructional delivery assignments to each trainee in accordance with specifications established in the MIMDC and ensure that the assignments are compatible with other job task assignment controls/prerequisites established at the job task control level within the system.

2. Materials - Instructional materials for ITS-supported job-site training will need to be developed in a variety of forms corresponding to the specifications provided by the instructional strategy design and media selection process. Assignment generation will require providing references to the specific materials required/ available for each instructional activity identified in the master instructional management and delivery control data base. A package of materials for a task knowledge instructional activity should include, at a minimum:

- A list of the learning objectives for each assignment within the instructional activity.
- Any special instructions for the trainee on the use of the materials, such as how to obtain adjunctive resources.
- The learner-paced instruction required for the attainment of the objectives.
- A self-test based on the learning objectives of each assignment.
- A guide for self-remediation, keying self-test items to the location of the correct information in the instructional material; e.g., page number, frame number.
- Instructions for accessing the specific test to be taken upon completion of study.
- Feedback statements to be generated by ITS for trainees, resulting from each input.

Options available to developers for task knowledge instruction include the following types of materials:

- o Programmed text booklets.
- o Trainee workbooks using adjunctive materials such as TOs, AFRs, etc.
- o Learner-controlled slide/tape programs.
- o Single-concept films.
- o Audio tapes with adjunctive materials.
- o Tutorial guides for trainers.
- o Computer assisted instruction (CAI).

To provide an acceptable degree of control of trainee progress, and better integration of OJT into the production environment, task knowledge assignments should be designed for a maximum study time of approximately 2 hours. Segmentation of instructional activities will allow a training developer to achieve these goals.

Options for materials to be provided for instructional activities related to the practical training of a task include the following:

- o Trainer guides and task breakdowns for demonstrations and practice activities.
- o Printed programmed job task plans for trainees.
- o Slide/tape job task demonstration sequences.
- o Single-concept films.
- o Simulation of field case problems provided by computer-driven or stand-alone devices.
- o Feedback statements to be generated by ITS for trainees and trainers as a result of each input.

3. Media and Devices - This function was designed to provide a means to employ multi-media instructional materials, training devices, and any simulators, CAI devices, or other high technology training devices needed for delivery of instruction during the training process and to define the requirements for interfacing them electronically with the system when the capability exists. The assignment generation function previously described for making assignments to instructional materials, media, and devices based on specifications established in the MIMDC, also is designed to generate a schedule demand for the resource.

When a training resource in this component is also electronically interfaced directly with other functions of the system, a notification to establish a suspense for the assignment could be generated. The trainee would then sign on to the device and remain under the temporary control of the device until the designated instructional delivery was completed. The results of the assignment would then be summarized by the device in the format specified by the MIMDC instructional assignment and forwarded to the trainee evaluation function for determining the next assignment.

This function of the delivery component also allows taking advantage of all state-of-the-art instructional presentation media. Of particular interest is the use of those media in computer-assisted instruction (CAI). The instructional material could be controlled in one of two ways and in either case provision must be made for the interface of the CAI hardware to the ITS computer. First, CAI lesson presentation could be controlled by the ITS computer directly. In this case, the interface must allow for high volume transmission between the CAI terminals and the ITS computer. Care must be exercised so that the performance of the ITS support stations are not degraded by the CAI processing. Second, CAI lesson delivery could be controlled via a micro-computer incorporated into the CAI terminal. In this case the instruction would reside external to the ITS computer on the micro-computer's storage medium. The micro-computer would also incorporate the capability to bring various other instructional delivery devices into the learning process. Provision would also need to be made for the interface of these devices with the ITS computer for the transmission of summary performance data to the ITS data base. The following generic types of instructional delivery devices were envisioned for use in the ITS:

- Low-cost black-and-white terminals without graphics capability .
- Full-capability color graphics terminals .
- Simulators.
- Stand-alone micro-computer devices.
- Part-task trainers.

4. Training Management and Evaluation Interfaces - This function was incorporated to address the essential interfaces which must exist in order to initiate, conduct, and conclude the instructional delivery process. Such interfaces include the following types of capabilities:

- Software to enable delivery resources to be scheduled, allocated to groups and individuals when required, and restored to "available for use" status when the delivery function is concluded.

- o Trainee skill and knowledge testing to be conducted when appropriate in the learning process.
- o Storage and update of detailed performance data gathered during the delivery process.
- o Reporting of the achievement of key milestones related to instructional activity status.
- o Appropriate notification of changes in task certification status to be made.

OJT Evaluation Subsystem. The OJT evaluation subsystem of the ITS was designed to provide the means to assess trainee task knowledge and proficiency and to collect and analyze data related to the efficiency and effectiveness of the Air Force OJT system. In general, it would accomplish all of its functions by analysis of data generated within the overall system, either through its own quality control process or through other ITS subsystems and components. Components within this subsystem were identified as follows:

- o Trainee evaluation component
- o Training quality control component
- o System evaluation component.

a. Trainee Evaluation Component. This component would provide the means to evaluate trainee performance and progress related to both specific tasks and duty position qualification. Performance data collected within the ITS to be utilized as measures for trainee evaluation include assignment/module-completion time data, trainee response data, remediation data, certification and decertification data, and training QC evaluation data. Knowledge testing would be based entirely on the prerequisite knowledge learning objectives for specific tasks; proficiency testing would be based on the performance and proficiency objectives derived within the ITS training requirements management component. In addition to programmed evaluation checkpoints within the task training process as specified by the master instructional management and delivery control (MIMDC) function, evaluation instruments for specific tasks performed in the work center would be accessible by supervisors for use in assessing airman proficiency on an impromptu basis. Further, all airmen would be subject to random task proficiency evaluations (on any tasks in the ITR on which the airman is currently certified and is required to perform in his/her assigned duty position) conducted by the training QC section as part of the external evaluation function of the ITS.

b. Training Quality Control Component. The purpose of this component is to provide systematic task proficiency evaluation procedures in order that the effectiveness of the training conducted within the OJT system may be assessed. It should be emphasized that the primary intent of this quality control process is not to assess the airman, but rather to assess the quality of the training that the airman

received and to correct any deficiencies detected. This training system quality control process would consist of three major steps:

- Quality control pre-evaluation procedures/activities: The process that randomly identifies a task and the airman to be evaluated, selects a qualified third party evaluator to conduct the evaluation, and schedules the evaluation.

- Quality control external evaluation process: The process whereby the evaluation is actually conducted utilizing specifications defined for the task in the MIMDC.

- Quality control post-evaluation procedures/activities: The process through which the results of the evaluation are reviewed and corrective action is taken.

c. System Evaluation Component. This component would provide a means to analyze quality control, training performance, and other data collected within the ITS to measure the quality of training accomplished and evaluate the effectiveness and efficiency of the training system in meeting the requirements of OJT. Major functions to be accomplished in this component include the following:

- Unit training analysis: The methodology for and production of a variety of management information summary reports identifying training accomplished, the status of the unit in achieving its training goals, and the effectiveness of unit training in meeting the requirements of the mission.

- Training system effectiveness analysis: The methodology for and production of a variety of management information summary reports identifying the degree to which the ITS meets the OJT system performance standards established by the Air Force.

- Training system cost analysis: The methodology for and production of a variety of management information summary reports identifying the cost of training at the job site and the efficiency of unit training in meeting the requirements of the mission.

- Training system capability/capacity analysis: The methodology for and production of a variety of management information reports (a) concerning the capacity of a unit to conduct OJT so that relationships between training load, training quality, and unit training effectiveness can be established, and (b) identifying deficiencies in training capability due to non-availability and/or inefficient utilization of training resources or lack of qualified trainers.

Computer Support Subsystem. This subsystem is essential for providing the various computer hardware and software components of the system. It contains the hardware, terminals, communications links, and

software required to sustain the OJT management, development and delivery, and evaluation subsystems.

Personnel and Support Subsystem. This subsystem provides the means for specifying the personnel and organizational requirements for the overall operation of the system and providing the training packages needed to indoctrinate the users of the system. It would also include required logistics and maintenance functions. With respect to the ITS development effort, it would provide a plan for transitioning the system throughout the Air Force and ensure that system implementation, operation, and expansion requirements are provided to the user.

V. DISCUSSION

A research and development program of the scope suggested by the ITS functional specifications has implications for the Air Force related to job-site training and training management issues which have, in the past, been considered in isolation rather than in the context of the overall readiness posture of the Air Force. The definition of the functional requirements, and their organization into a system in which critical relationships between training and training management functions and the unit mission are identified, should ultimately provide the capability to respond more readily to readiness requirements. A more detailed view of some of the specific issues that will need to be addressed in the development and Air Force-wide implementation of the ITS, and a discussion of problem areas which are likely to be encountered, should be helpful to those managing the effort. These issues are grouped, insofar as possible, into critical R&D implications, essential elements of implementation, and long-term impacts on other personnel programs.

Critical R&D Issues

The issues within this category are critical to reaching the objectives of the ITS, in that they deal with the major functions of defining valid individual training requirements, establishing measures of training effectiveness, and controlling the quality of training, all of which are deficient in the current OJT system. The ITS could not function to standardize training and evaluation, nor could user acceptance of the training system be gained, should the Air Force decide to relegate the decisions involved in resolving these issues solely to work center production personnel. An appropriate level of R&D which directly addresses these issues and provides methodologies that can work as a part of the training system, is essential to the long-term success of the ITS and the OJT system which it will support.

The ITS training requirements management component will have, in some degree, the following structure. First, it is envisioned that a master task list (MTL) will be constructed for a specialty. This list would be a standardized source of tasks from which both generic and specific position task lists can be constructed. Second, it is also envisioned that generic position training requirements (GPTR) task lists would be constructed from the MTL. Here a "position" refers to an individual's job. A GPTR must be a list that includes "important" tasks that are common to a group of similar individual duty positions. Finally, an operational position training requirements (OPTR) task list would list the tasks for a particular unique duty position. An OPTR would serve as the basis for identifying, controlling, and monitoring an individual's training on his or her current job. It will not

necessarily be the case, at least at the outset, that these various task lists can be constructed in the sequential order in which they are described here.

MTL Construction

In the context of the ITS, the major purpose of an MTL is to provide standardization of tasks across specific individual duty positions (a duty position is the work done by exactly one individual) and, insofar as possible, across generic positions or job types as well. At the same time, task descriptions should be sufficiently specific that activities whose differences are important for training are, in fact, different tasks. Finally, it is important that MTLs have a simple relationship to those used in other Air Force data bases--particularly that of the occupational survey program. In short, tasks must not be too specific, because of loss of standardization, as well as for practical reasons. Nor should they be too general, because extremely broad tasks are not likely to be useful in identifying and controlling training requirements and job performance skills. Determining the appropriate level of specificity is, as may be seen, an important issue which must be addressed in constructing MTLs.

As mentioned above, another important consideration in constructing tasks for an MTL is comparability to other data bases. Perhaps the most salient of these data bases is that of the Air Force occupational survey program. Occupational surveys provide much information which is used in training-related activities, such as determining job classification structure, aptitude requirements for various career fields, and formal training requirements. Task data routinely gathered in occupational surveys include percentages of job incumbents performing tasks, relative time spent in performance of tasks, learning difficulty, and recommended training emphasis for first-term airmen. In order to ensure compatibility of the ITS with Air Force job classification, personnel acquisition, formal training, etc. and in order to use occupational survey data in the ITS to manage training requirements, MTL tasks should have a simple relationship to occupational survey (OS) tasks. Ideally, the relationship might be one-to-one. This would imply that the maximum number of MTL tasks be less than 1700 (the maximum number of tasks that can be handled by most Comprehensive Occupational Data Analysis Programs [CODAP]). The practical limit to the number of tasks per specialty which can be handled by OS technology is approximately 1200 to 1300. Further, this implies that OS task lists could be the primary or, at least, the major source of tasks for an MTL.

Another question is whether OS-type tasks are sufficiently specific for ITS purposes. OS data have been used for years in determining requirements for formal resident training provided by the Air Training Command (ATC). This would seem to suggest that OS-type tasks are sufficiently precise. However, OS task data are not used in isolation--they can be and often are broken down according to equipment used, job type (groups of specific positions which are homogeneous with respect to tasks performed--analogous to generic positions) and many other relevant

variables. This suggests a way of achieving greater task specificity in the ITS while maintaining compatibility between MTLs and OS task lists. OS tasks could make up an MTL, while additional codes could be contained in the ITS identifying relevant variables for identifying subgroups of airmen for whom particular tasks differ in content--say, types of equipment used or job type (generic position) groupings.

In some specialties, other task-oriented data bases are available. A major example in maintenance-oriented specialties is the Logistics Composite Model (LCOM) data base. As with OS data, data from sources such as LCOM may be useful in the ITS. Such data bases may also serve as sources of MTL tasks. Thus, it is important to identify such task data sources and to achieve some compatibility between MTLs and such data bases. However, these data bases are not necessarily compatible with the OS data base either in tasks used or in types or formats of data available. Thus, it may not be possible to achieve complete compatibility. In cases such as these, it will be necessary to decide which compatibility is most important. Consideration in this decision should include numbers and types of tasks, types of data available, and the usefulness of such data in the ITS; compatibility of the ITS with other decision-making based on such data; and standardization within the ITS. This last point deserves further comment. Information from most of these data bases is available only for certain job specialties; for example, LCOM data are available only for maintenance specialties. OS data are available for most specialties. Thus, one of the trade-offs that should be considered in the ITS design is between having different procedures for different specialties depending on the types of data available and having common procedures for most or all specialties using data which are usually or always available. Even OS data are not available for all specialties. Thus, it is advisable that MTL files (as well as all of the ITS) be structured not to depend on any single data source. The other side of this issue is that OS or other data bases could be modified to meet ITS needs.

In constructing MTLs, one should start with existing tasks from OS data or other sources as appropriate. To ensure compatibility, tasks from such sources should be modified as little as possible. However, provisions should also be made for tasks to be added that emerge from elsewhere in the ITS--particularly from OPTR task lists.

Identifying Generic Position Training Requirements

GPTRs are intended to be lists of tasks which are common to groups of similar specific duty positions. GPTRs are also sources of tasks for OPTRs, as well as a means for monitoring and controlling specific position training.

The first step in constructing GPTRs involves identifying generic positions. Two general approaches might be used for this purpose. The first is an a priori approach. In this approach, generic positions would identified through a rational analysis of how work is structured. In specialties such as Security Police in which a particular

organizational structure is mandated by regulation, the various positions defined by regulation might serve as generic positions for the ITS. In other specialties, where such mandated structures are not found, subject-matter experts might identify generic positions.

The other general approach for identifying generic positions is an empirical approach. In this approach, data would be gathered from individual job incumbents concerning their job content. Then groups of incumbents would be identified whose jobs have similar content. This latter empirical approach is routinely used in the OS program to identify job types. Data are gathered from job incumbents concerning the relative amount of time spent on all tasks in their specialty. Then, through a statistical procedure known as hierarchical cluster analysis, groups of incumbents are identified whose work times are similarly distributed across tasks.

An important issue in the ITS design concerns which of these two general approaches will be used to identify generic positions and what specific procedures and data will be used. The ITS development contractor's preference might well be for the empirical approach and, more specifically, for the procedures used in the OS program or some variation thereof. Because a particular position's structure is mandated does not necessarily mean that the structure actually exists as such in the real world. In particular, more or less specialization may be found than is mandated. If the mandated structure is the real work specialization structure, that fact will emerge from the empirical approach. If the mandated structure does not emerge, then something is wrong, and it may be that what needs correction are the regulations. In most specialties, no mandated work structure exists at the work center level. The rational procedure in this case (i.e., subject-matter specialist input) would really be just a very unsystematic application of the empirical approach. In essence, subject-matter experts would be asked to describe the structure of the work as they have seen it (or as they think it should be!). Particularly in light of the fact that supervisors do not generally have as good an idea as incumbents of what incumbents actually do on the job, data gathered from subject-matter experts are likely to represent a small and probably biased sample of actual work content, whereas a more thorough application of the empirical approach, as in the occupational survey program, would be more likely to produce a larger, more reliable, and less biased set of results.

Another important issue in identifying generic positions concerns the specificity of these position groupings. This specificity could range from one generic position for an entire specialty to each specific position having its own unique generic position. Clearly neither of these two extremes is appropriate for the ITS design, since generic positions function to allow some generalization across positions while maintaining some accuracy of descriptiveness of the real work beyond that of an entire specialty grouping. Current occupational survey job types might not be at an appropriate level of specificity for the ITS training requirements management functions (although some evidence

exists that job types are appropriate). This problem can easily be remedied through the CODAP cluster analysis methods used in OS. As mentioned above, a hierarchical clustering method would be used. In this method, a sequential series of cluster solutions are obtained, starting with the case in which each incumbent forms his or her own cluster and becoming more general or aggregated until the final solution consists of one big cluster containing all job incumbents. This means that clusters, job types, or generic positions of any desired homogeneity can be found among the various hierarchical solutions obtained (provided that clusters of the desired homogeneity actually exist among the job incumbents). The point is that even if current OS job types are not at an appropriate level of specificity for the ITS design, OS analysis procedures could probably be modified to produce appropriate generic positions.

Once generic positions have been identified, GPTRs need to be constructed for the generic positions. Given identified generic positions and task performance data for incumbents in the generic positions, the problem would be to select tasks which are "important" across specific positions within a generic position. Two issues arise here--how to measure the "importance" of tasks to generic positions and how "important" a task must be to a generic position before it is included on that generic position's GPTR. One important factor in the "importance" of tasks within generic positions is how widespread performance of the task is among incumbents. This might be measured by the percentage of position members who perform the task, or the amount of time spent on the task by position members. Another factor in the "importance" of tasks in positions for ITS purposes is task difficulty. Extremely easy tasks probably do not need to be put on GPTRs because training is not normally an issue in such tasks. Other task characteristics, such as various criticality measures, may also be important. Task performance (percent members performing and percent time spent) and task difficulty data are routinely gathered in the OS program. Other task characteristics could be gathered via OS technology or by other means. The questions confronting ITS developers concern what task characteristics should be measured, how to measure them if such data are not now routinely gathered, and how to combine them into an overall selection criterion variable for including tasks in GPTRs.

Given an overall "importance" score, or at least, scores on several relevant variables, procedures will need to be developed for deciding which tasks will go onto a GPTR. The main issue here concerns whether all tasks should be included on a GPTR which might go onto OPTRs for at least a few airmen in a few positions or whether only those tasks which are relevant to most or all airmen in a generic position should be included. This decision will, in turn, depend to a great extent on the degree to which GPTRs constrain supervisors in task selection versus simply serving as a convenient source of tasks for OPTRs.

Constructing Operational Position Training Requirements Task Lists

A critical issue in constructing OPTRs concerns the degree to which supervisors will be constrained by the system first, in selecting tasks to go on OPTRs and secondly, by the tasks on their OPTRs once constructed. At one extreme, specific positions could be assigned to generic positions by the system; OPTRs would be identical to corresponding GPTRs and supervisors would be responsible to train on all tasks appearing on an incumbent's OPTR (which is equivalent to the GPTR in this case). In this arrangement, no opportunity would exist for local modification of OPTRs or of actual tasks trained. At the other extreme, the MTL and GPTRs would exist solely as a source of tasks for locally constructed OPTRs. Supervisors would be free to put any tasks desired on OPTRs and to provide any level of training desired on OPTR tasks. It is unlikely that either of these extreme cases would be used in practice, although much local flexibility should be allowed. In any case, the degree to which "the system" is prescriptive concerning OPTR content and training will have a significant impact on procedures for constructing OPTRs, as well as for constructing GPTRs and MTLs.

Four major steps will probably be required in constructing OPTRs. First, each operational position must be identified, if possible, by selecting the closest generic position match. That could be done semi-automatically by having incumbents (or perhaps supervisors, keeping in mind that supervisors generally have less knowledge than incumbents of tasks actually performed) indicate tasks that are in the operational position, and then using statistical means to identify the generic position most similar to the operational position. Another approach would be to provide supervisors with all GPTRs and let them select generic positions for their specific positions.

The second major step in constructing OPTRs (the steps need not be done in this order) is to select tasks from the GPTR of the generic position to which an operational position has been assigned. The main issues here concern guidelines and data about tasks which need to be provided and used for this purpose--in particular, the degree to which OPTRs are constrained to include tasks from assigned GPTRs.

The third step concerns selection of other tasks from the MTL to go on OPTRs. Again, an important issue concerns the degree to which OPTRs are constrained to include or not include such tasks from an MTL that are not on a position's GPTR.

The last step involves adding to OPTRs tasks which appear neither on a position's GPTR nor on that specialty's MTL. Several issues appear to be important. First, it seems desirable to encourage use of tasks from the MTL and GPTR rather than using locally written tasks, where possible. Yet it also seems necessary to provide for use or input of local tasks. Given the possibility for local tasks, some form of quality control will be needed for constructing task descriptions for such tasks and for evaluating training on such tasks. Also, provision should be made for local tasks to be placed on MTLs and GPTRs if it

turns out that such local tasks are really more widely performed. This would involve collecting local tasks at some central location, screening them, and feeding them back into the system. Screening would be required because the same task may appear in somewhat different form in different locations when tasks are locally developed. Provision is needed to identify such situations and to construct a task statement that will be acceptable to all relevant locations.

Training Effectiveness Index

A potential feature of the ITS is its ability to provide measures of training effectiveness or training status. This could be done both for individual job incumbents and for entire organizations.

Consider, first, training status measurement for one person. The first step involves measuring a person's performance on all tasks on that person's OPTR. Ideally, this would be done by actual performance tests. In practice, construction and administration of performance tests for all tasks and job incumbents may not be practical. A reasonable alternative involves relying on supervisor or OJT trainer evaluations of task performance, which would be audited by performance testing on sample tasks and incumbents. Construction of these performance evaluations is not a simple matter. In some respects, a go/no go approach may simplify evaluation, but, particularly in actual performance testing, some complications arise as well. A typical performance test measures level of performance, and a go/no go system requires that it be decided in advance what level of performance is sufficiently good to be considered "go." In other words, minimum passing scores need to be set (at least implicitly) for such tests.

Given "can perform"/"cannot perform" measures for all tasks (including locally developed tasks), the next issue concerns how to aggregate these measures into an overall performance index for an individual job incumbent. An obvious approach would be to compute the proportion of OPTR tasks that an incumbent has been certified to perform. With this type of measure and supervisor emphasis on achieving high training effectiveness scores for their subordinates, it would be very tempting for supervisors to put as few tasks as possible on OPTRs. This would subvert the objectives of the system. Positive incentives in some form for people to put all "important" tasks on OPTRs and to conduct honest performance appraisals should be included in the ITS. In fact, positive incentives for people to not "game the system" are a critical aspect of the ITS. In overall performance measurement, one way to encourage supervisors to put appropriate tasks on OPTRs might be to use a measure in which that percentage of tasks certified is weighted by the number of tasks on an OPTR, rather than the simple proportion of OPTR tasks that have been certified. In such a measure, lower percentages of task performance would be compensated for by having more tasks on an OPTR, encouraging supervisors to put tasks on OPTRs even though more tasks might reduce the percentages that can be performed at a given point in time.

It is probably the case that some tasks are more "important" or "critical" to overall successful mission performance of an organization. This suggests that, rather than just using percentages of OPTR tasks that can be performed, a more accurate picture of an organization's true training status would be obtained if tasks were weighted by criticality in an overall performance measure. This would require that measures of task criticality be available. Occupational survey R&D results indicate that measuring task criticality presents some difficulties. First, one must very carefully define exactly what is meant by criticality. Secondly, it appears that criticality cannot be measured as a single task characteristic, at least by OS task factor measurement procedures. Instead, it is necessary to decompose criticality into several task characteristics. Any one of these characteristics may or may not be relevant in a particular specialty. In the OS training emphasis R&D, criticality was decomposed into consequences of inadequate performance (How bad is it if the task is incorrectly performed?) and task delay tolerance (If you find out right now that you need to do a task, how long do you typically have before the task must actually be done?). In some specialties, little variation has been found among tasks on these factors. In other words, all tasks were about equally critical, as measured by these factors. The implications of this for criticality measurement in the ITS are that several task characteristics will probably need to be measured and combined into one overall index.

Another issue in task criticality measurement concerns comparison across jobs and specialties. Typically, as in OS methodology, criticality task characteristics are measured by having subject-matter experts--people familiar with the tasks and jobs containing the tasks--rate the tasks. Such subject-matter experts usually can rate only tasks in one job specialty because they are not sufficiently familiar with more than one specialty. Thus, task criticality ratings cannot be compared across specialities. However, in the ITS one would want to be able to compare training effectiveness across job specialties. This is particularly true for generating organization-level effectiveness measures, as will be seen below. For ITS purposes, not only is there a need to develop task criticality measures, there is also a need to gather those data so that the values are comparable across specialties. At AFHRL, this problem has been termed the "benchmark" problem. At least two approaches have been tried for gathering benchmarked task data. The first is that used in the aptitude requirements R&D, in which expert judges were given an opportunity to study and observe selected sets of tasks in several specialties and eventually to rate those tasks. From benchmark task ratings on these subsets of tasks, relative ratings of other tasks can be translated into the benchmark scale. The other approach is essentially statistical in nature and has been used to benchmark strength and stamina task ratings.

Once individual-level training effectiveness measures have been constructed, it would be useful to have organization-level measures. In order to do this, a means of combining individual-level scores into a single organization score must be developed. Since an organization typically contains people in several specialties, to compare

organizations with different combinations of specialties requires that individual-level scores be comparable across specialties--the benchmark problem. Organization-level measurement may also require that organization task or mission criticality be measured--a whole additional issue for investigation.

Input to OS from ITS

Much of this discussion has concerned ways in which the OS methodology and data base can support the ITS. The ITS can also support the OS system. Some of the possibilities are discussed here.

If the ITS MTLs are compatible with OS technology and if procedures exist in the ITS for locally developed tasks to be entered into the overall system, then the ITS can provide a continuously updated source of task lists for OS studies. While the USAF Occupational Measurement Center (OMC) has a program in place today to update task lists continuously, that might be accomplished in a more thorough or efficient manner via the ITS.

Assuming ITS tasks will be compatible with OS tasks, the ITS can provide task-level data that would be useful in job analysis. One example of this is time-to-train data. These time-to-train data will probably not be available for all tasks, but data of that type for some or most tasks would be useful. Task-level performance ability data are also potentially very useful. One application of those data would be in developing and validating personnel selection and assignment procedures. Clearly, OJT training status data would also be relevant for determining requirements for and effectiveness of formal training--an important application of the OS process.

The ITS could serve as a means of gathering other OS data--both task performance data and task factor characteristics data. This could allow the OS data base to be updated on an almost continuous basis.

Training Quality Control

The training quality control functions of ITS are intended to provide the data required to make accurate assessments of the degree to which the training meets Air Force mission requirements. Some R&D considerations in deriving training effectiveness indices for individual airmen and organizations have been identified above; the appropriate external mechanisms for their validation, and the detection and correction of training problems at both the work center and the system levels is yet another area for major R&D support. One issue to be resolved concerns task performance evaluation. The task and airman selection algorithms devised must provide assurance that sample sizes are adequate to provide valid training assessment data. Secondly, and closely associated with this, is the efficiency to be gained if task performance can be evaluated reliably using mechanisms other than direct, third-party evaluations and, if not, the effectiveness of critical part-task evaluation procedures. Finally, and not the least

important, is the identification of the significant factors affecting user acceptance of the external evaluation process and results.

Implementation Issues

This category of ITS transition issues concerns important elements of the system concepts and functions which could receive too little emphasis from managers and others involved with the program. Most of the elements of the ITS have user acceptance implications, and this should be considered to be of major significance in ITS transition to Air Force-wide use.

The role of supervisors and trainers within the present OJT system includes the functions of determining job training requirements; planning and scheduling the training; delivery and tracking of training; assessing the quality of training; and recording and reporting training accomplished. This role will change significantly with ITS implementation. In most work centers, the new role will involve the following of procedures and guidelines for task training pre-established by others, and providing data related to training the task to the system. One might expect that such a role change would be welcomed. However, most ITS management and evaluation functions will rely heavily on receiving accurate and timely data. This requirement could be perceived as an increase in data input functions to be performed by trainers and supervisors, suggesting a compromise to dilute or circumvent essential controls and functions of the system. The resultant fluctuations in both training quality and individual or unit training evaluation capabilities could adversely affect the acceptance of the ITS at the base level. Associated with this aspect of user acceptance within the work center, the Air Force should ensure that the system design includes a sufficient number of user computer terminals to eliminate manual recordkeeping.

A second essential element of transition to Air Force-wide use of the ITS involves the need for strict observation on the part of training developers of controls on instructional and trainee management. A tendency of developers to transfer responsibility for these controls to trainers and supervisors rather than building them into the instructional strategies could develop, resulting in negative effects on training quality and standardization.

Issues concerning the development and maintenance of large quantities of job-site instructional materials and instructional management controls constitute a difficult problem in ITS implementation. Included in this problem is the establishment or designation of an organization which can provide sufficient standardization of training development processes. This will involve coordination of training development with AFS functional managers and AFS users to resolve problems such as:

development prioritization within and across functional areas; availability of subject-matter expert (SME) support; ways in which to adjust training and evaluation to compensate for local variations in task performance requirements for the same task; specific-task training approval and implementation decisions; and allocation of task training materials and equipment maintenance responsibilities.

Closely associated with these training development issues is one which concerns the distribution of functions at the MAJCOM/SOA and higher level agencies which are related to base-level training management for AFSs. These functions include task performance standards review and approval; training revision requirements identification, prioritization, and coordination; MAJCOM transition planning and tracking; distribution of training materials; and coordination of job-site training evaluation for the correction of deficiencies. A similar set of new functions related to MAJCOM/SOA AFS users will exist for weapon system, equipment, and functional area-specific training. The Air Force will have to assign responsibility for these new functions at levels commensurate with efficient and effective management and budgetary control.

The assignment of management responsibility for training at each base is essential to ensuring the success of the system. The functional responsibilities reflected in Table 4 describe many requirements that must be satisfied in an appropriate organizational structure that considers mission priorities. The operational organization for training system management of all base-level training will need a structure which can effectively distribute responsibility and authority for training quality control, training cost control, management information interfaces, training resource management, instructional management, and training delivery.

While the functions above relate directly to management responsibilities, each unit OJT manager should play an important role as part of the base-level pool of training expertise. Training quality control functions, for example, should be shared by all OJT managers, particularly assisting in trainee evaluation and maintaining coordination between training development, delivery, and system evaluation functions. On the other hand, the unit manager should be geographically located, for the most part, in the unit or squadron which he or she services. This would help to ensure that the ITS is responsive to the unique training requirements at the work center/ section levels.

It is with these considerations in mind that the current base-level OJT management responsibilities were reviewed in conjunction with the factors considered in defining OJT system requirements. An effort was made to determine the scope of organizational changes that may be required to support management of a new OJT system effectively.

The current base-level OJT management function is assigned as a subordinate unit to the CBPO under the Directorate of Personnel.

Placement of OJT management responsibilities at the base personnel level is not considered to be the best organizational alternative for the following reasons:

- The Directorate of Personnel is on the same authority line as agencies where most job-site training occurs. This situation currently creates difficulty in implementing training policies and procedures. These problems could be magnified considering that the ITS would incorporate qualification training management functions that increase the need for more direction and visibility than is currently provided.

- Work center production, in most specialties, is dependent on a sound job-site training program. While management of job-site training is currently a personnel function, the responsibility for assuring work center production is not a base personnel function.

- When task proficiency is not demonstrated after training certification, it is not a base personnel problem, but a mission capability problem.

- When changes occur in mission priorities, weapons systems, and workloads, or when contingencies arise affecting training, they are not base personnel problems. Such problems are mission *responsiveness problems.*

- When training is not efficient or cost effective, it is not just a base personnel problem. It is a broader mission-related problem.

- Job-site training relies heavily on the use and availability of operational equipment. Shortages and misallocation of such equipment, when they affect training for the mission, are not personnel problems, but are training resource management problems.

- Training accomplished in support of mission readiness is a 24-hour-per-day, three-shift operation, whereas base personnel is typically an 8-hour-per-day, one-shift operation. For this and other reasons, the base personnel organization is often considered by production-oriented work centers to be an "outside activity" relative to job-site training.

It is therefore concluded that improved training could be achieved by a separation of personnel and job-site training management functions in order to elevate training management to an authority level commensurate with responsibility for base-wide mission accomplishment. It is recognized that some personnel programs rely on data provided via the OJT system. This support should continue to be provided from the ITS.

Long Range Implications for Other Manpower and Personnel Functions

The current OJT system provides data used directly or indirectly to implement other personnel policies; e.g., classification policies establish prerequisites for award of AFSC skill levels, which include knowledge and qualification requirements. The classification system relies directly on the OJT system to provide the training needed to satisfy these particular prerequisites at the specialist and technician levels. Promotion policies are indirectly affected, in that award of a particular skill level is a prerequisite for promotion to a specific grade; e.g., 5-skill level for E-4; 7-skill level for E-6.

No change in the relationship of OJT to other personnel functions is envisioned as a result of implementation of the ITS. However, the types of data provided via the ITS may invite changes to policies or the ways in which these policies are implemented.

Classification/Utilization

AFR 39-1, Airman Classification Regulation, contains within certain specialty descriptions the requirements to perform specific tasks prior to award of an AFSC skill level. If a trainee has not previously performed and attained qualification on these tasks, the ITS could identify these as training requirements. If a trainee is assigned to a position where these tasks are not performed, utilization policies and procedures should support rotation to a position where performance and qualification requirements can be satisfied. For example, AFR 39-1 requires personnel in AFSC 431X1 to attain hands-on aircraft maintenance experience, but some trainees are assigned to Job Control or Technical Order Publications Librarian positions in which actual maintenance is not performed. These trainees need position rotation to obtain the required experience.

The data to be provided by the ITS relevant to qualifications of personnel could present opportunities for improved assignment selection procedures when specific qualifications are required to perform in critical duty positions. This would probably be most beneficial when short-notice, contingency/emergency operations must be activated or when one-deep positions must be manned.

Quality Force/Promotions

The ITS would provide capabilities for assessing individual qualifications and progression of training on a task-by-task basis. The availability of these data could influence ratings on Airman Performance Reports (APRs), particularly within the area of "training responsibilities." Since the Weighted Airman Promotion System (WAPS) considers APR ratings in the promotion selection process, greater opportunity for selecting the most qualified persons may be presented.

Manpower

Studies conducted by Management Engineering Teams (METs) to measure manpower requirements may be enhanced through the availability of data relevant to specific tasks performed within functional areas and to time required to train/perform tasks within work centers and positions.

VI. CONCLUSIONS

There is great potential for increasing both the effectiveness and efficiency of mission-oriented training by the application of computer technology to the functions of instructional management, scheduling, reporting, external evaluation, and recordkeeping. However, such support provided for those functions should be accompanied by guidance and capabilities which reaffirm the Air Force commitment to the principles of Instructional System Development for all training, including task-oriented training. This guidance should clarify the relationships between the components of the training system and the job. Tasks must be identified in more specific terms and keyed to jobs to allow more positive identification of training requirements for those jobs. Requirements for task performance must be derived from specific duty position requirements and not be established merely to conform to a hierarchy of skill levels. Training must be administered, managed, and delivered in modes which consider individual differences in ability. Perhaps most importantly, task- and mission-oriented training must be evaluated using appropriate measures. It is in training settings with these characteristics that computer-based technology can provide the management and administrative functions that will ensure that airmen can perform with required proficiency those tasks for which they are trained.

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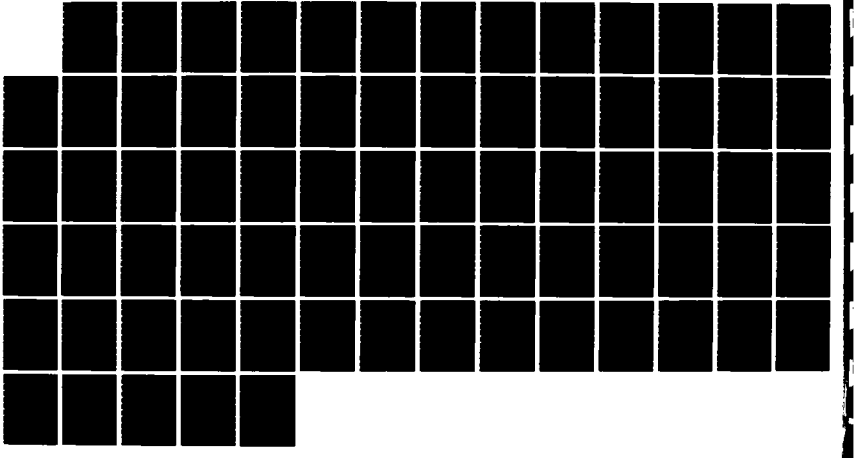

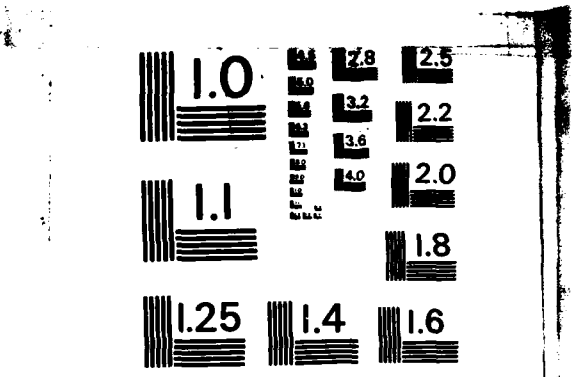

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APPENDIX A

ITS INTERVIEW PROTOCOL FORMS

POSITION SURVEY

DAFSC:_____ POSITION:_____

PAFSC:_____ COMMERCIAL PHONE NO:_____

2 AFSC:_____

NAME:_____ RANK:_____

MAJOR COMMAND/AGENCY OJT FUNCTION

- ☐ MAC
- ☐ SAC
- ☐ TAC
- ☐ OTHER:_____

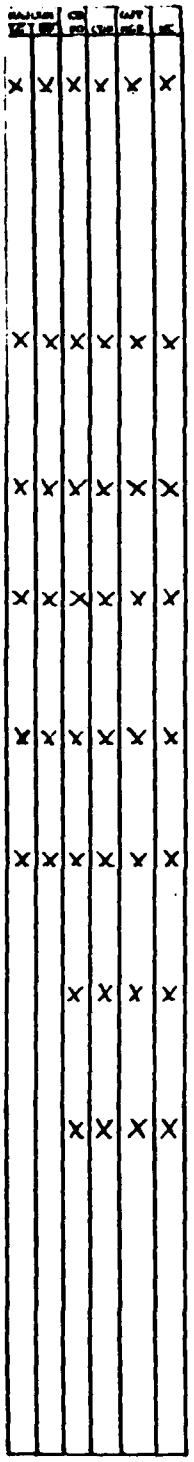
- ☐ MAJCOM OJT STAFF
- ☐ MAJCOM FUNCTIONAL MANAGER
- ☐ CBPO OJT STAFF
- ☐ COMMANDER
- ☐ WING TRAINING MANAGER
- ☐ SQDN/UNIT OJT MANAGER
- ☐ SQDN/UNIT TRAINING COORDINATOR
- ☐ WORKCENTER SUPERVISOR
- ☐ IMMEDIATE SUPERVISOR
- ☐ TRAINER
- ☐ OTHER:_____

ORGANIZATION:_____ OFFICE CODE:_____

BASE:_____ ON-BASE LOCATION:_____

ATTACHMENTS:

- ☐ Record Summary Sheets
- ☐ Report Summary Sheets
- ☐ Form Summary Sheets
- ☐ Training Summary Sheets
- ☐ CDC Surveys
- ☐ Trainee Considerations Surveys
- ☐ Continuation Sheets



(D1) Training Development & Delivery Subsystem - Task Proficiency Objectives

D1.1 The OJT program has been criticized for not being responsive to mission requirements. In your opinion, how could OJT, particularly in the task proficiency area, be reoriented toward mission requirements?

D1.2 Where are the conditions and standards now specified for JPG task performance?

D1.3 Who should develop task proficiency objectives?

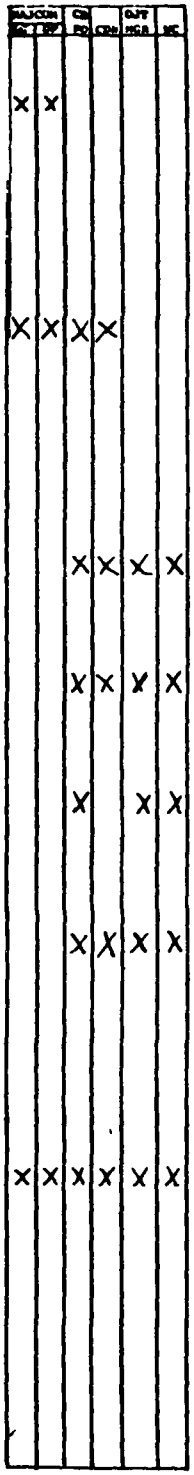
D1.4 Could occupational survey data be collected which could be utilized to formulate task proficiency guidelines?

D1.5 Could task proficiency objectives be derived from any other source?

D1.6 How specifically should task proficiency objectives be stated *(behavior, conditions, standards)*?

D1.7 How many times should a trainee perform a task to be signed off as proficient?

D1.8 Can task proficiency objectives vary for the same task as a function of changing positions?



(D2) Training Development & Delivery Subsystem - Job Rotation Objectives

D2.1 What is the AF policy regarding job rotation within specific functional areas/specialties?

D2.2 What opportunities for job rotation are available within the MAJCOM/ weapons system?

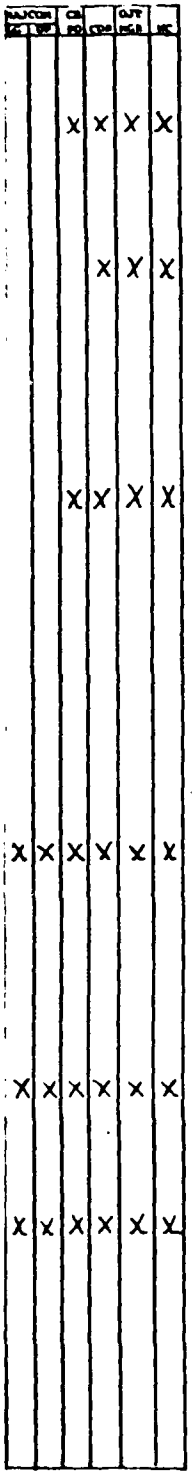
D2.3 How frequently does planned job rotation occur? Unplanned?

D2.4 What general constraints are applicable to the job rotation policy?

D2.5 How does the job rotation policy/standard affect qualification training?

D2.6 Are there any specific constraints applicable to the AFSCs selected for the initial ITS design?

D2.7 What does the concept of job rotation imply for ITS, OJT, etc.?



(D3) Training Development & Delivery Subsystem - Interface, Occupational Survey

D3.1 In your opinion, is occupational survey data being translated effectively into OJT training requirements?

D3.2 How can occupational survey methodology be expanded to make it more responsive to the problem of defining training requirements?

D3.3 Should occupational survey data serve as a control for the:

JPG?

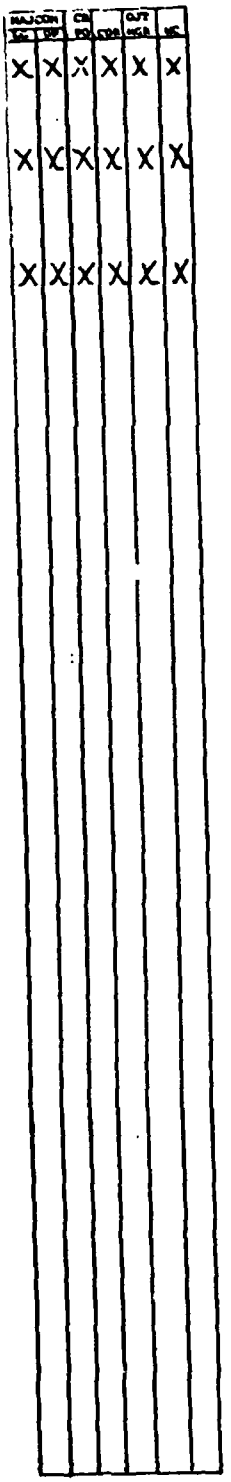
STS?

Task-by-position data base planned for ITS?

D3.4 What are the strengths, or advantages of using occupational survey data to formulate OJT training requirements?

D3.5 What are the disadvantages/weaknesses of the concept of using occupational survey data to formulate OJT training requirements?

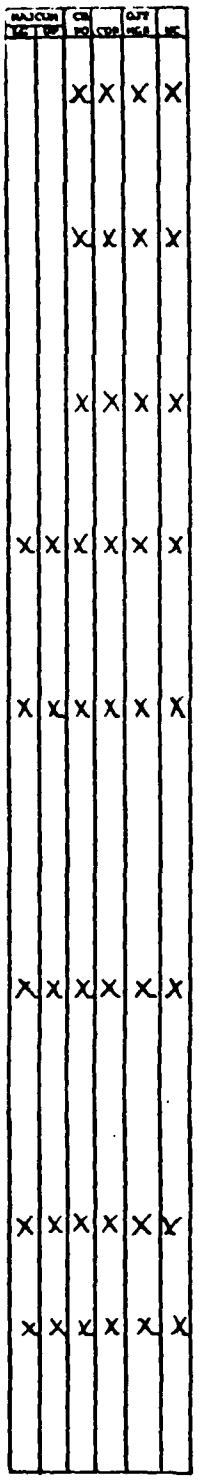
D3.6 For what purpose should occupational survey data be used if not to determine training requirements?



D3.7 Could ITS generate a task list for occupational surveys?

D3.8 Could ITS serve as a validation tool for occupational surveys?

D3.9 Who should be responsible for implementing into the OJT system the results of occupational survey data?



(D4) Training Development & Delivery Subsystem - Interface, STS

D4.1 Is the STS as currently developed, in sufficient depth or detail to be utilized for all present or potential functions of the STS?

D4.2 Does the current proficiency code key adequately describe to you an individual's actual qualification for performance on the job? What are the deficiencies?

D4.3 Should the STS reflect general tasks applicable to all AFSCs? (i.e., administrative, management, supervision, safety, etc.)

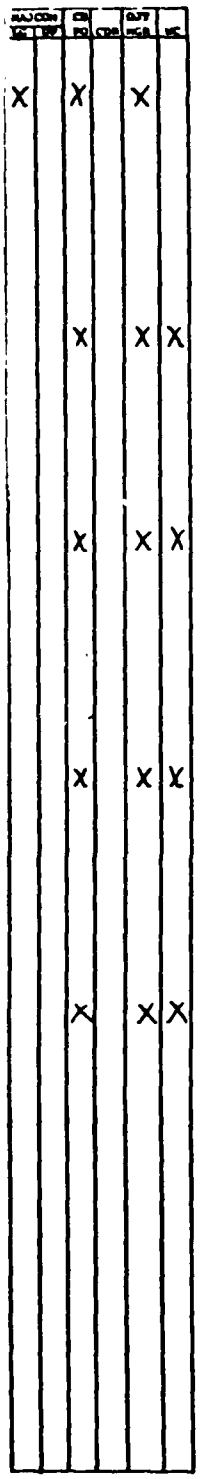
D4.4 What separation should exist between the functions of the STS and the JPG? (i.e., should STS be oriented toward career/advancement whereas the JPG is oriented to a position/job/specific task?)

D4.5 What are your perceptions on providing a more clear-cut division between career knowledge (STS, CDCs) and job knowledge (specific instructional materials)? What would be the affects on promotion and retention?

D4.6 What should be the function of an STS in a training system which provides only job/task knowledge andproficiency, not career knowledge?

D4.7 Who should be OPR for an STS used only for career development? For an STS used for both career development and task proficiency progression?

D4.8 What source document(s) should be used to create an STS?



(D5) Training Development & Delivery Subsystem - Training Aids

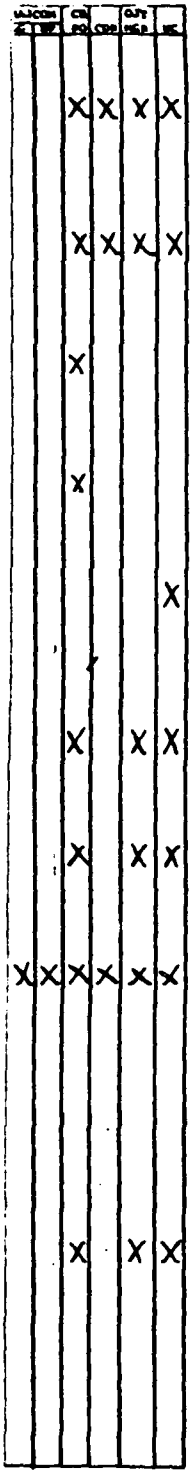
D5.1 What instructional technology is employed within the MAJCOM for OJT and ancillary training? Who develops? Who funds?

D5.2 What instructional technology is employed at this base/unit?

D5.3 Describe the specific uses of instructional technology at this location. (checkout, checkin, testing, evaluation/validation)

D5.4 Are there problems in maintaining an adequate inventory of multi-media materials? Training devices?

D5.5 Are there allocation problems when the demand for multi-media materials is high?



(D6) Training Development & Delivery Subsystem - Task by position data base

D6.1 Where are jobs and/or positions on this base/sqdn/unit identified and approved?

D6.2 Are positions based on a standard organization?

D6.3 How many different AFSCs are represented on this base?

D6.4 How many different positions are established at this base?

D6.5 How many tasks are defined in this work center? Is there a master JPG?

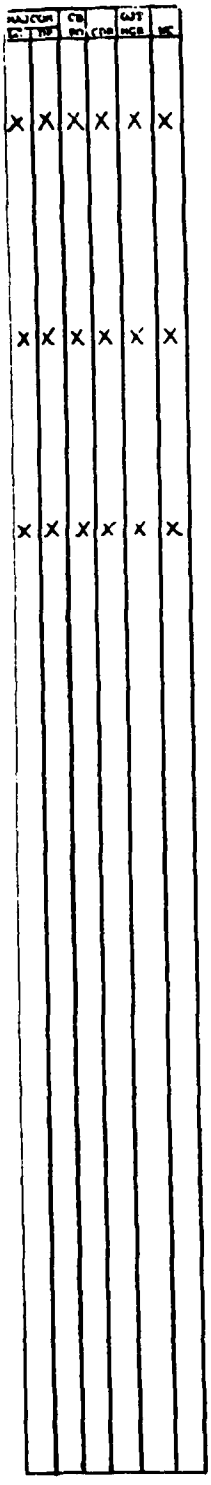
D6.6 Who should build the task by position data base?

D6.7 Who should maintain the task by position data base?

D6.8 Who should be able to access the task by position data base:

For inquiries?
For update purposes?

D6.9 What are your preferences concerning where and when the JPG should be generated?

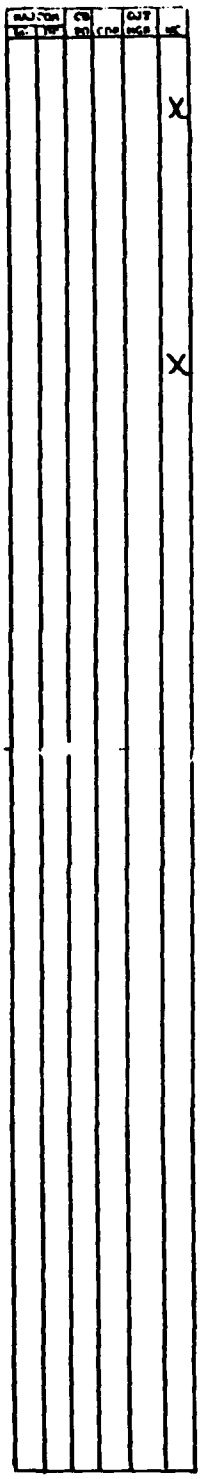


(D7) Training Development and Delivery Subsystem - Trainers

D7.1 Should the trainer for each task be identified in the trainee's training record?

D7.2 What qualifications should a trainer meet?

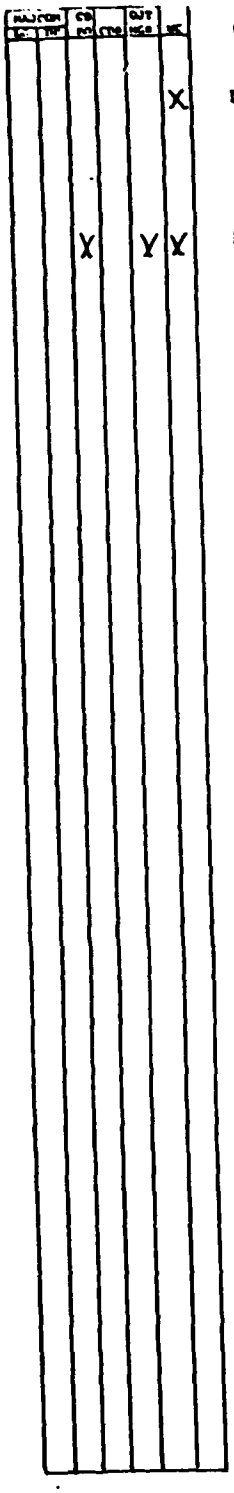
D7.3 How should the certification of trainers be documented?



(D-A1) Simulation of Tasks Not Found on Job

D-A1.1 Which tasks which are the responsibility of positions in this workcenter are performed so infrequently that they cannot be trained? (Contingency, mobility, etc.)

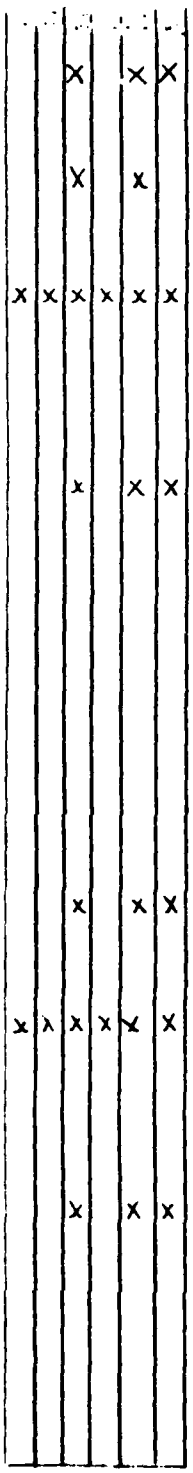
D-A1.2 Which skills related to tasks performed in this workcenter could be gained through simulation?



(D-A2) Job Reading Training

D-A2.1 About what percent of personnel in this workcenter have been enrolled in the base reading improvement program?

D-A2.2 Has this program improved comprehension of job-related reading materials? (If not, why not?)



(M) Training Management Subsystem - Entry, diagnosis of need

M1.1 Who assigns airmen to positions?

M1.2 Who enters trainees in UGT?

M1.3 Should the ITS diagnosis of training needed occur prior to assignment, when the airman reports to the base, or when the airman reports to his unit?

M1.5 What base-level training should not be considered in the ITS diagnosis of needs?

PME?

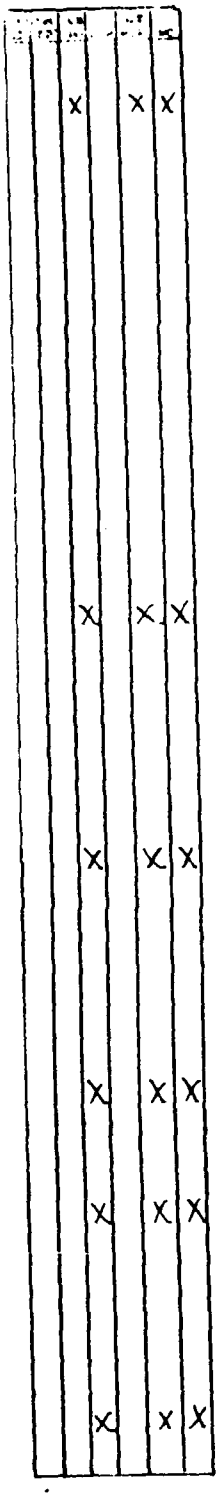
Orientation?

Ancillary?

M1.6 Who should be responsible for initiating the ITS diagnosis?

M1.7 If the ITS diagnosis is automated, should the results be verified and approved? By whom?

M1.8 What AFSC-unique or work center-unique training requirements are not satisfied by the present OJT system?



(M2) Trainee Management Subsystem - Prescription and Scheduling

M2.1 How is the scheduling of training events at base/unit accomplished? (Draw flow showing positions involved, time frames, coordination meetings, etc.)

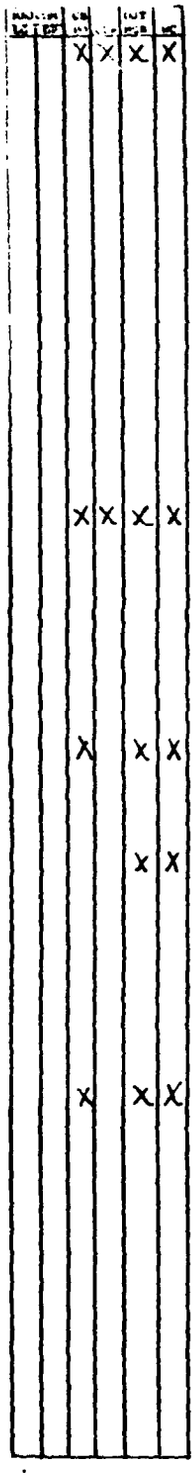
M2.2 How many people are scheduled per month (base, wing, unit)? (Obtain copies of schedules)

M2.3 Who is responsible for the scheduling function and how many others are involved in it?

M2.4 How frequently are schedules generated?

M2.5 Are there any automated aids to scheduling available?

M2.6 What are the training events scheduled? (Obtain listings)



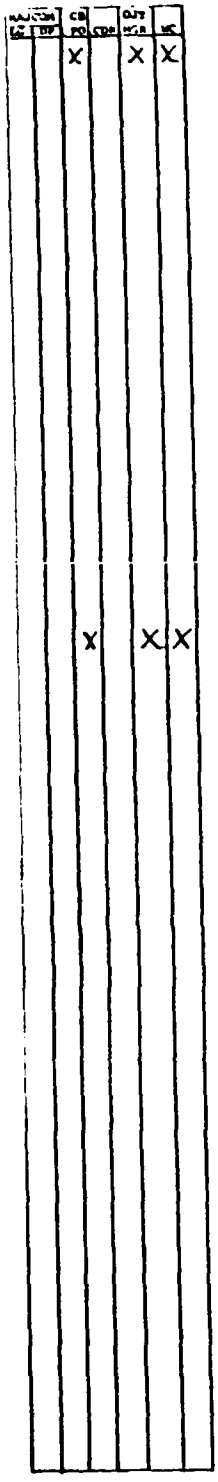
M2.7 What are the problems encountered in scheduling standard OJT and ancillary training activities? Non-standard activities?

M2.8 Do problems exist relative to the quota control and scheduling of FTD courses? What are they?

M2.9 How do trainees acknowledge the proposed schedule?

M2.10 Does the training schedule have to be compatible with the flight schedule?

M2.11 What other critical events must be compatible with the training schedule?



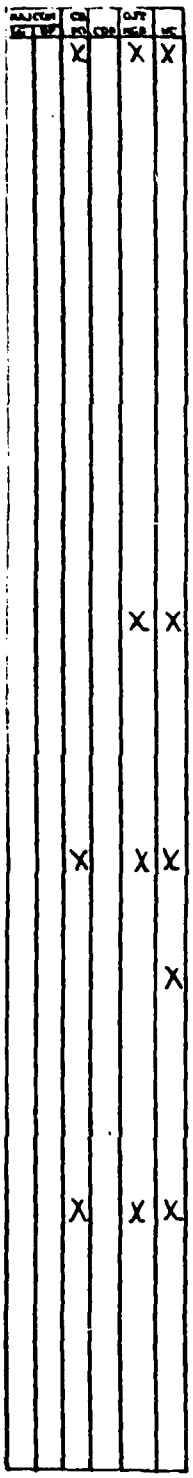
M2.12 How are sessions scheduled for:

a. Knowledge (Classroom)

b. Performance

(Draw flow as required)

M2.13 How are trainees scheduled for multi-man task performance training and testing? (Draw flow as required)



M2.14 How is testing scheduled for:

a. Knowledge?

b. Proficiency?

(Draw flow)

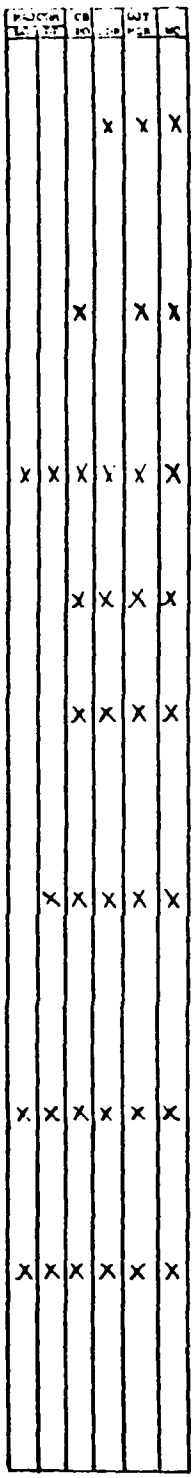
M2.15 What feedback does the trainee receive after proficiency testing?

What feedback does the WC Supervisor receive after proficiency testing?

M2.16 How is scheduling accomplished for CDC CE administration?

M2.17 What are the procedures for providing CE review training in this workcenter?

M2.18 How is CDC CE review training scheduled?



(M3) Trainee Management Subsystem - Individual Training Records.

M3.1 What are squadron/unit requirements for tracking individual trainee progress in OJT?

M3.2 What tracking aids (records or charts) are employed by you to check on progress of trainees toward task proficiency? (Obtain copies of all records & forms utilized)

M3.6 Should a permanent, individual training record be initiated after Basic Military Training?

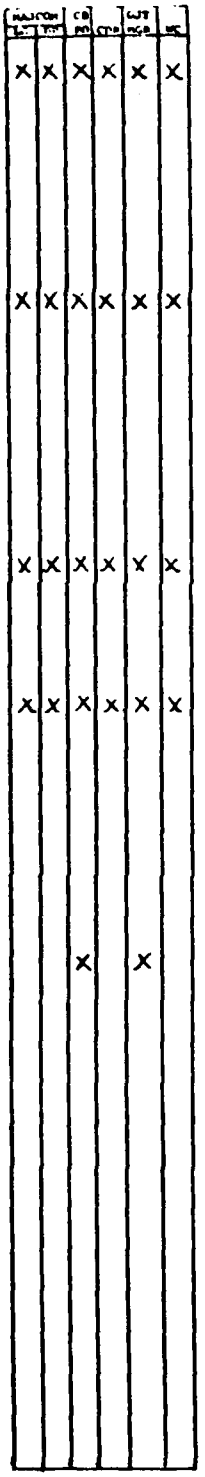
M3.7 How often is each individual training record (623) accessed by you?

M3.8 For what reasons do you access the individual training record (623)?

M3.9 What elements of the AF Form 623 do you single out for extra attention when you examine it?

M3.10 Who else needs access to an individual training record (623)?

M3.11 Is the information required from an access of the individual training record (623) desired immediately?



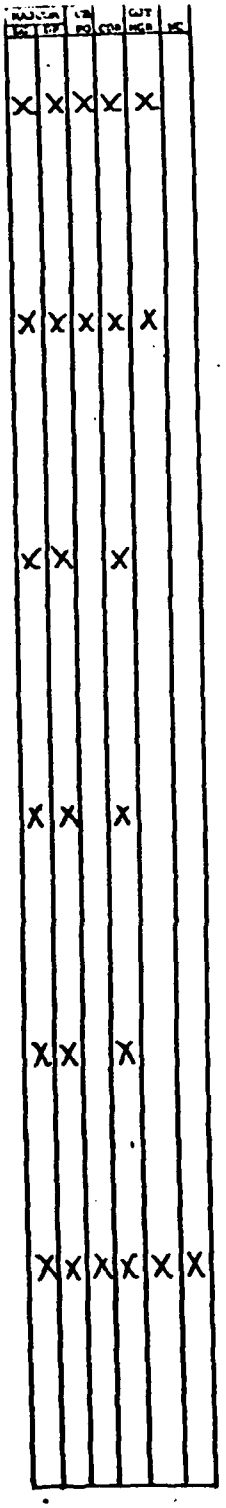
M3.12 What information currently collected in the 623 is not needed?

M3.13 What information needs to be collected that is not presently available in the 623?

M3.14 How long should information collected in the individual training record be retained?

M3.16 What security procedures must be followed in the maintenance of the individual training record?

M3.17 Do you maintain a GSU and do they have an OJT Program? (Outline features)



(M4) Trainee Management Subsystem - Unit Training records

M4.1 What levels of management require aggregate unit training data?

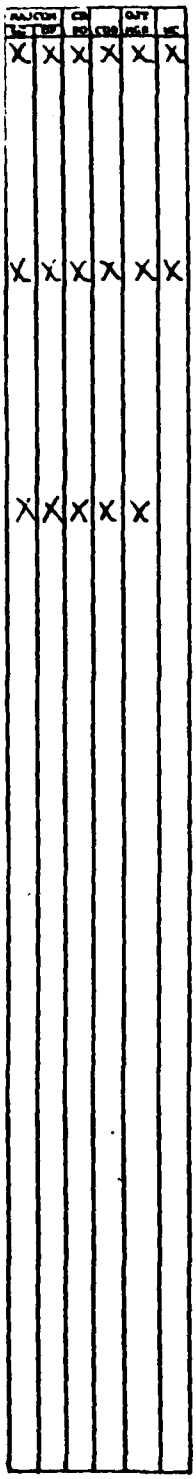
M4.2 What levels of management (by organization component) now receive aggregate unit training data?

M4.3 What aggregate unit training and unit task proficiency/verification data is required to assess training responsiveness to mission requirements?

M4.4 For what purpose is aggregate unit training and unit task proficiency/verification data [illegible] ?

M4.5 What source(s) currently produce unit training data?

M4.6 What should be the relationship between the unit training record and the ATC graduate evaluation program?



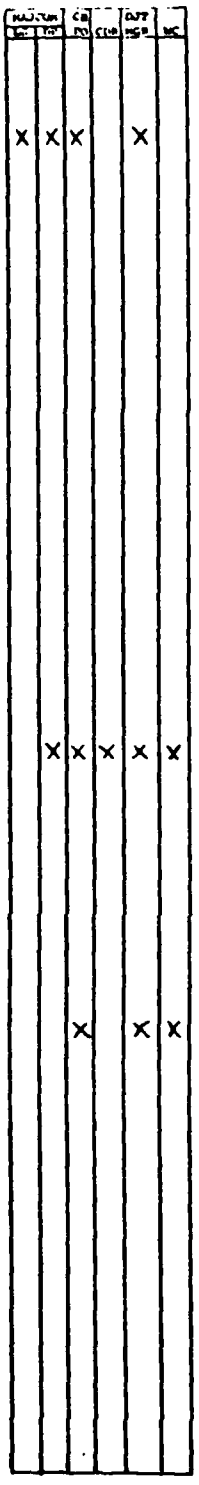
M4.7 What are your perceptions of the value of the training now being provided and its cost?

M4.8 What is your perception of the need to summarize projections of training to be accomplished in the future?

M4.9 Is there any value to be gained by producing statistics related to maximum training load?

Utilization?

Capacity?



(M5) Trainee Management Subsystem - Interface, CDC, MMICS, PDS

M5.1 Is ADP support now provided for any functions or aspects of the OJT program?

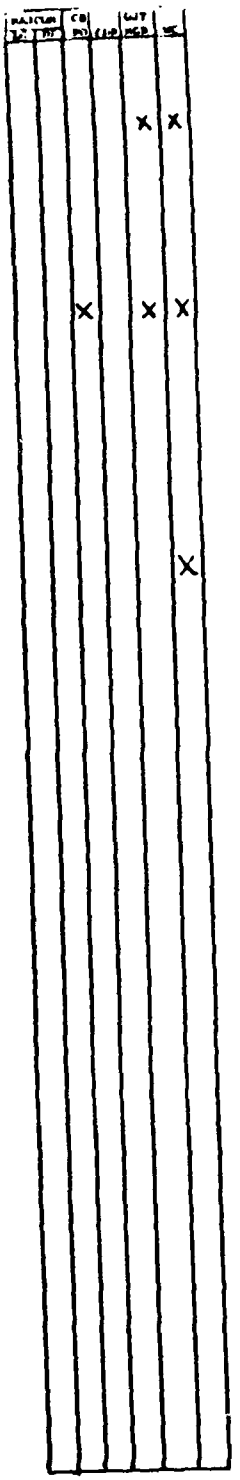
If yes, what levels of support are provided? (specifics)

For which positions is the support provided?

M5.4 What training data exists on PDS (obtain listings) which are particularly useful to you?

M5.5 What inputs to ADP systems are made by you?

What are the difficulties in making these inputs?

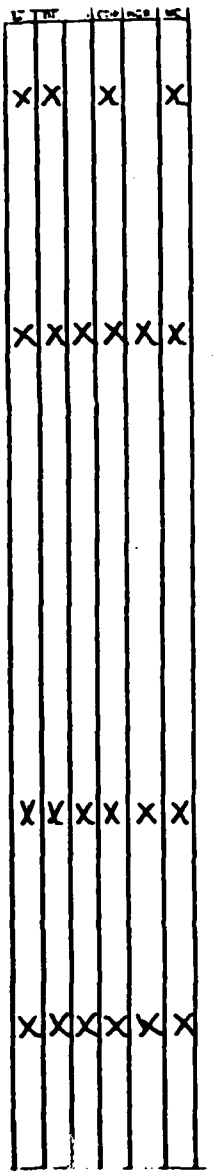


(M6) Trainee Management Subsystem - Resource Allocation

M6.2 To what degree is equipment available for proficiency training and testing? Items in short supply?

M6.3 How are training facilities, equipment, films and special instructors for OJT and ancillary training scheduled and provided?

M6.4 Who maintains the technical library in this unit?



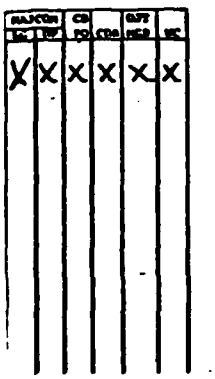
(M-A1) Skill-level Indices

M-A1.1 How is workcenter mission capability defined with respect to skill levels?

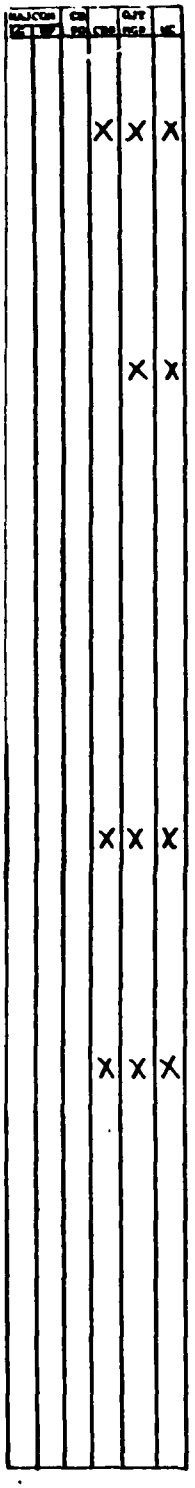
M-A1.2 What, in your opinion, is the present relationship between skill levels and task proficiency?

M-A1.3 Should skill levels reflect only proficiency in presently assigned position?

M-A1.4 Should a means be devised for deriving an indicator of skill level based on the number and type of positions held within the specialty area, number and types of tasks performed, and the level of proficiency demonstrated?



M-A1.5 What factors do you think should be considered in defining skill levels? (e.g., task proficiency, task knowledge, career knowledge, training, etc.)



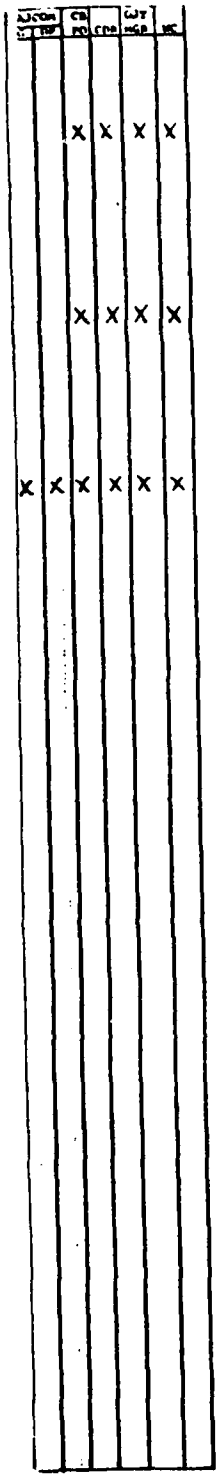
(E1) Evaluation & Tr. .ning Analysis Subsystem - Individual performance evaluation

E1.1 How is task proficiency evaluation conducted in this squadron/unit/ workcenter?

E1.2 Do proficiency tests require that all trainees perform all aspects of multi-man tasks? How is this accomplished?

E1.3 How would you respond to the suggestion that JPC task performance should be tested periodically after upgrading?

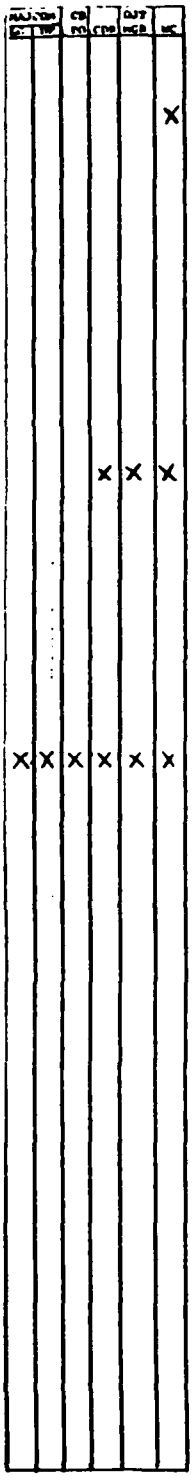
E1.4 What impact does the Maintenance Standards Evaluation Program (MSEP) have on the OJT program in this career field?



E1.5 Who should certify the completion of tasks assigned to a trainee?

E1.6 How should task certification be accomplished?

E1.7 Should there be a base-level quality control function for all OJT task evaluations?



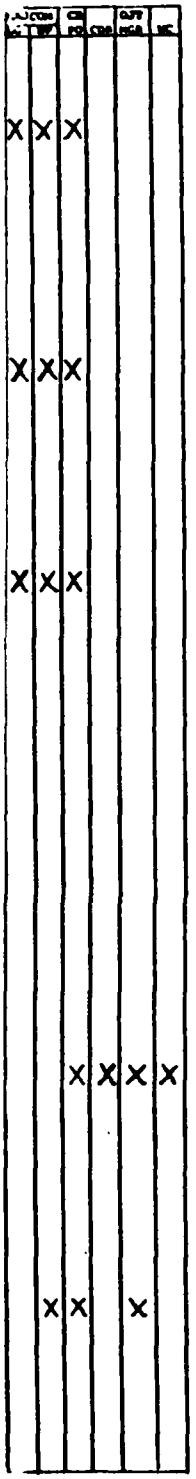
(E2) Evaluation & Training Analysis Subsystem - Cost and capacity analysis

E2.1 Do you find that your normal production duties in the workcenter adversely affect the functions expected of you in the OJT program? Where are the conflicts?

E2.2 What problems have you had relative to OJT capability and capacity?

E2.5a. Where do you believe that OJT as presently structured is cost effective?

b. Not cost effective?



(E3) Evaluation & Training Analysis Subsystem - Interface, MAJCOM & Air Staff Training OPRs

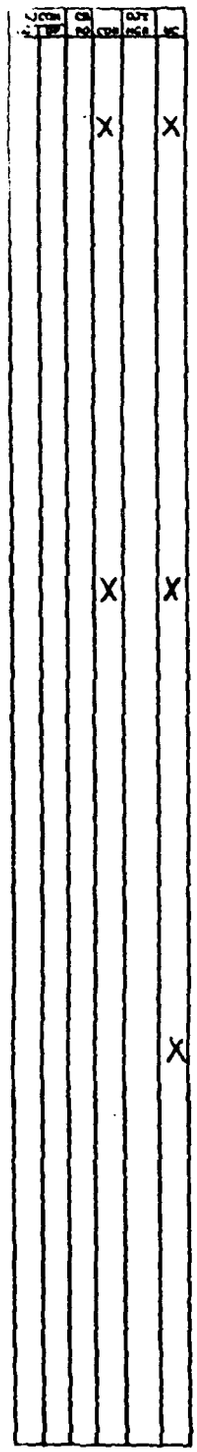
E3.1 Have MAJCOM OJT Staff and other training OPRs been kept adequately informed of problems within the OJT system?

E3.2 What areas, if any, require more definitive reporting?

E3.3 What additional reports, statistics, and/or revised reporting procedures would be desirable for HQ OJT staff and training OPRs?

E3.4 What measures which may be related to OJT are used by higher authority to evaluate your unit's performance?

E3.5 Is there a MAJCOM incentiveaward program in effect for OJT trainees and/or trainers? If so, what are the mechanics?

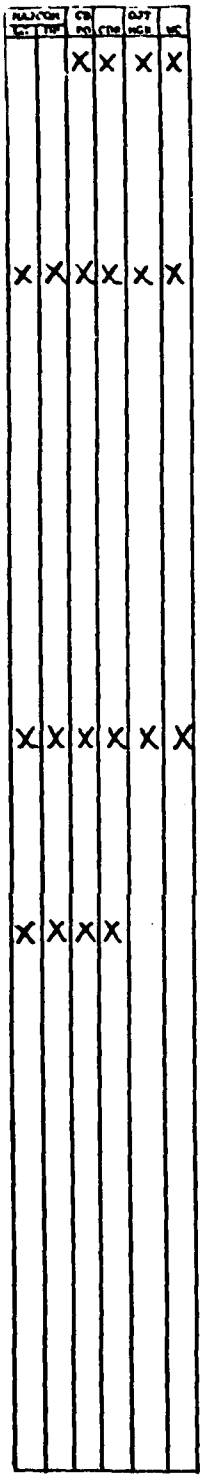


(E4) Evaluation & Training Analysis Subsystem - Training Effectiveness Evaluation (mission requirements)

E4.1 What measures are utilized by squadron OJT managers and others to assess the effectivness and efficiency of OJT in your units?

E4.2 What additional reports and/or reporting procedures would be desirable for you in the OJT program?

E4.3 By what means do you keep squadron, wing and CBPO OJT administrators informed of trainees' progress in OJT?

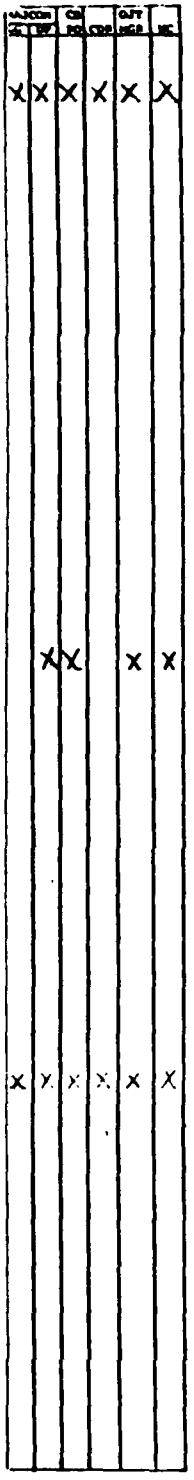


E4.4 What measures are utilized by CBPO OJT administrators to assess the effectiveness and efficiency of OJT?

E4.5 What statistics would reflect more accurately the degree to which OJT was meeting mission requirements?

E4.6 What statistics do you consider significant in evaluating OJT?

E4.7 Have you been kept adequately informed of problems within the OJT system? Where are the deficiencies?



(P1) Personnel Subsystem - Organizational and personnel requirements

P1.1 What are your perceptions on the concept of consolidation of trainir managers at the base level to:

a. Obtain better utilization of '75' personnel?

b. Increase training event scheduling effectiveness?

c. Eliminate fragmented management?

d. Improve capability for performing 3rd-party task proficiency evaluation?

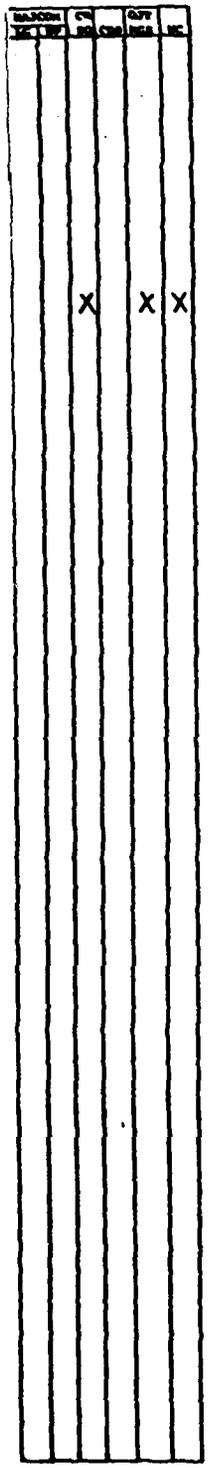
P1.2 Do you have adequate time to do what is expected of you in your role within:

The upgrade training portion of OJT?

Qualification training?

Other?

P1.3 Could OJT managers be reorganized in any other manner to improve their ability to manage the OJT program?



(C1) Computer Subsystem - CPU Support

C1.1 What functions (systems) are supported by the base-level system?

C1.2 What training functions are currently supported by the base-level system? (Obtain copies of PDS, MMICS products)

C1.3 Current base level system:

Name?

Memory?

Terminals?

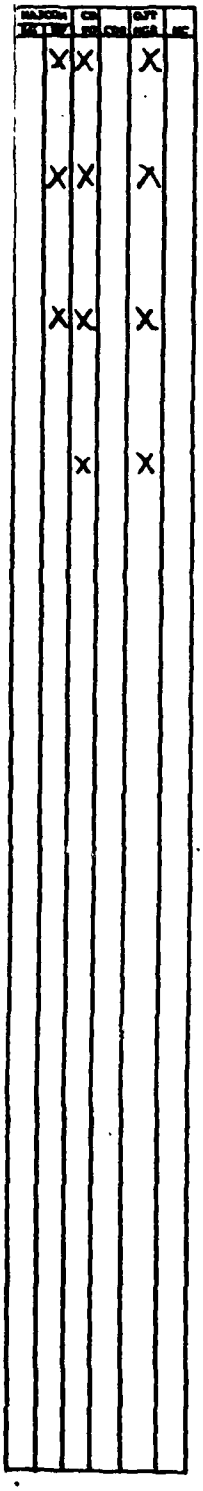
I/O devices?

Secondary storage?

Operating System?

Programming Language(s)?

Special Purpose language(s)?

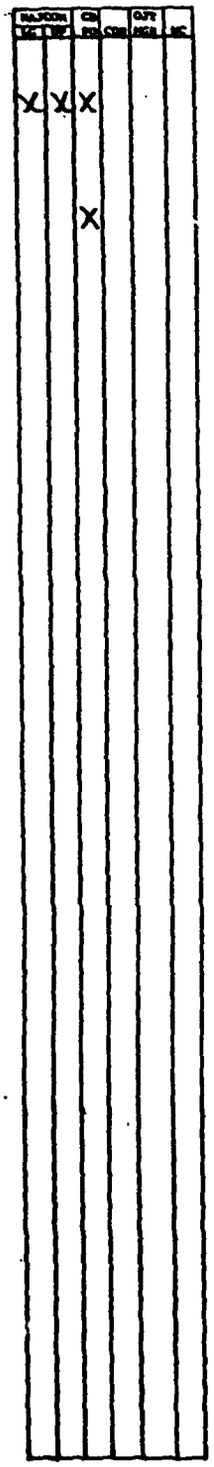


C1.4 What transportability features exist in the present base-level system for units sent to remote sites?

C1.5 What type of system(s) is/are currently in place which could be utilized for ITS?

C1.6 Can a distributed computer system be used effectively in the OJT environment?

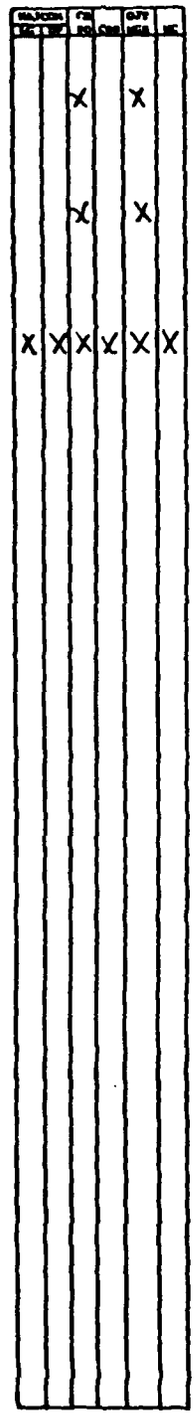
C1.7 What security features are incorporated in the current base-level system for remote terminal access?



(C2) Computer Support Subsystem - Communications

C2.1 What computer interfaces exist with other commands/bases?

C2.2 What is the current capacity for telecommunications on the base-level system?



(C3) Computer Support Subsystem - Terminals

C3.1 How is data entry accomplished on the current base-level system?

C3.2 What is the responsiveness, capability and capacity of the current data entry operation?

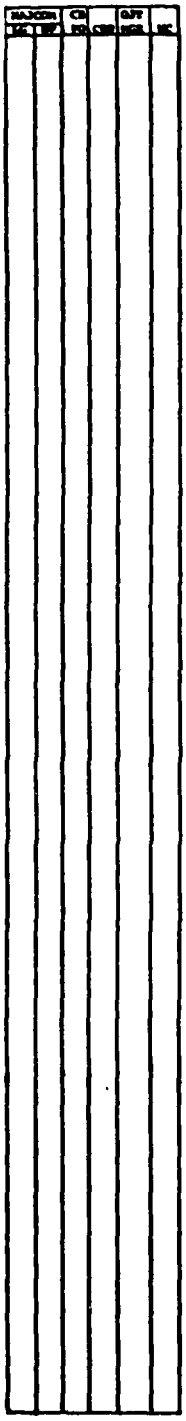
C3.3 How responsive should the ITS system be for:

Queries?

Data?

Reports?

Others?



(C5) Computer Support Subsystem - Application Programs

C5.1 Are all procedures employed in data automation centers covered in the MIL-STD-490 and AFR 300-12?

C5.2 What forms exist for use in systems documentation and standardization? (e.g., AF2053, AF2054, etc.)

APPENDIX B

ITS COMPUTER SUPPORT TRADE STUDIES ANALYSIS

APPENDIX B

ITS COMPUTER SUPPORT TRADE STUDIES ANALYSIS

Background

The purpose of the trade studies phase of this effort was to provide an analysis of the cost alternatives available for meeting various functional requirements, particularly those for computer support of Air Force OJT. The cost data produced were utilized in the trade studies analysis of the ITS alternative design options.

Alternative Computer Design Options for ITS

The requirements in Table 4 of the body of this report present some unique system design problems for the development of an Integrated Training System for Air Force OJT. The hardware/software options available are so extensive that it would be virtually impossible to identify three or four meaningful total system design concepts for Trade Studies Analysis. Preliminary analysis indicated that perhaps the most feasible approach to designing alternatives for the ITS would be to concentrate on smaller, independent aspects of the system. These could then be presented in a manner that would allow the Air Force to utilize a "mix and match" method for selecting the most promising options for the development of the trade studies analysis as well as for development of system specifications in the final system definition phase of this effort. This appendix describes alternative design options that were considered for:

1. Configuring the ITS computer network
2. Collecting detailed task training data for trainee management and evaluation.

ITS/PDS Considerations. Some very interesting parallel relationships exist between several of the functions to be performed in the ITS and some of the functions currently performed in the Air Force Personnel Data System (PDS). These relationships are illustrated in Figure B-1, which depicts many of the commonalities that exist between the two systems.

1. A requirement exists (see Table 4, F1) to provide a means to establish and maintain for each airman an Airman Training Record that would contain a history of training completed during the airman's career and that would be forwarded to each base of assignment. A small amount of training data is currently maintained in PDS, and these functions in ITS could be accomplished in the same manner as maintenance and forwarding of personnel data in PDS.

2. A requirement exists (see Table 4, F6) to collect and maintain information related to the personal attributes of each airman. This same type of data is also maintained in PDS.

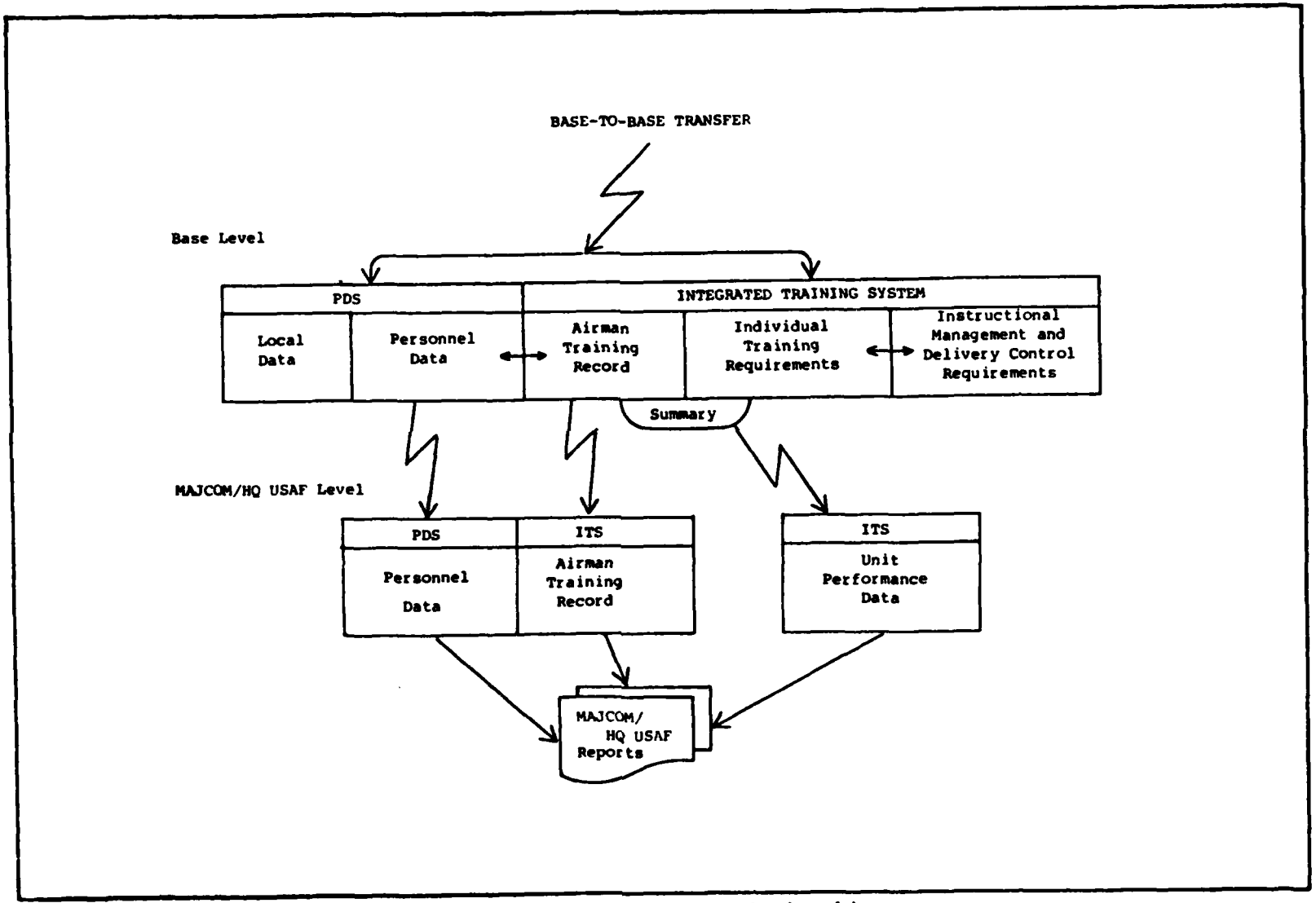


Figure B-1. ITS/PDS Relationship

3. Other requirements are (See Table 4, I2, L9, M3, M5, M6, M8, M9, M10, and M11) to provide analyses of ITS data and produce summary reports of unit training events and the effectiveness and efficiency of OJT to the MAJCOM/HQ USAF. PDS accomplishes this type of function in its three-tier vertical data flow concept.

4. A requirement is also defined (See Table 4, N3) to provide information to the PDS related to an airman's current position qualification and his/her current AFS development to support promotion, assignment, classification, and other career development objectives.

Discussions with AFMPC/MPCD data automation personnel during the data gathering phase of this effort indicated that it is conceptually feasible to consider designing the airman training record portion of the ITS system utilizing the PDS software system in order to take advantage of the data base management and horizontal/vertical data flow concepts already established. It would also be feasible to establish an interface between ITS and PDS through the PDS buffer transfer concept to accomplish updates of common data elements. Because of these factors, all ITS computer support alternatives consider the ITS airman training record as an integral part of PDS.

ITS Network Configuration Alternatives. The computer/data communications network options available to support a system of the magnitude projected for ITS are extensive. There are many different combinations of hardware/communications networks which potentially satisfy these requirements with the specific design dependent on the unique capabilities of each prospective vendor. The various alternatives applicable to the projected ITS requirements can be generally described in terms of (a) a dedicated large-scale centralized system, (b) a distributed, dedicated network of mini-computers, (c) a major, full-scale augmentation of the planned Phase IV base-level system to include ITS, or (d) a relatively minor augmentation of the planned Phase IV base-level system to support some components of ITS, with the remaining components supported by dedicated micro-processors and/or mini-computers. Each of these alternatives would include a Trainee Management Support System (TMSS) component. TMSS alternatives are described in the ITS Trainee Management Support Alternatives section of this appendix.

a. ITS Network Configuration Alternative A - Dedicated Large Scale System. This alternative, as depicted in Figure B-2, would provide a large-scale, multi-processing computer system at a single central site. Access to the computer from each base would be provided via a network of dedicated telecommunications lines interfaced with a message processor at each base. All ITS processing and updating of files would be accomplished at the central site. Interfaces with MAJCOMs, HQ USAF, and the PDS would be via AUTODIN, dedicated line, or mail from the central site. Support for the special base-level trainee management aspects of job-site training would be provided via micro-processor or small mini-computers interfaced with the message processor.

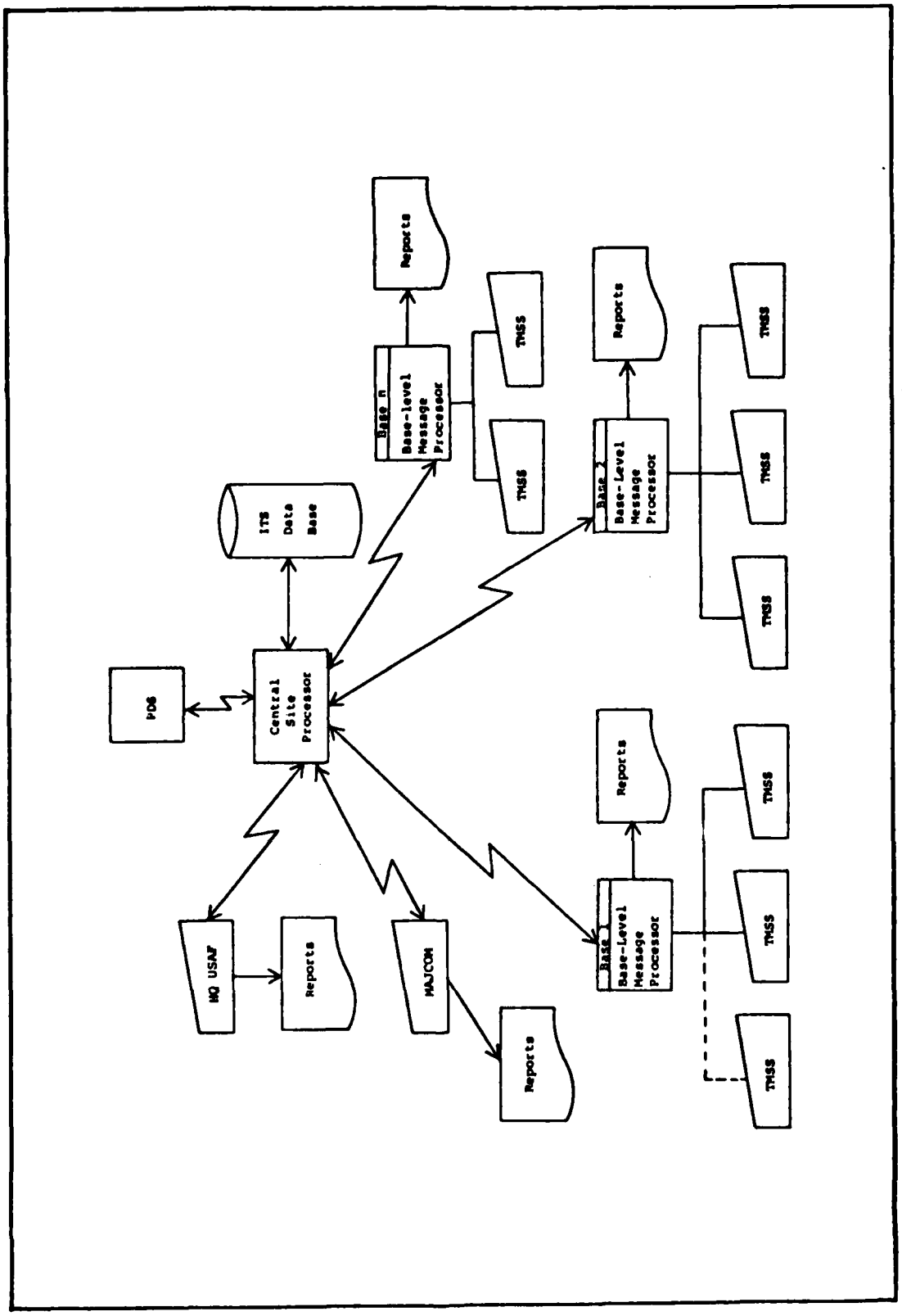


Figure B-2. Network Configuration Alternative A - Dedicated Large Scale System

The advantages of this alternative relate to benefits that are typically present in any large-scale, centralized computer system. Data base design and efficiency are easier to control. Software changes can be effected in a more timely manner. A typical large-scale system would provide for greater processing power in statistical analysis, simulation, modeling, etc. The cost of processing each transaction is usually relatively low.

From a negative standpoint, this alternative would require extensive use of data communications lines which have traditionally been a major weakness in interactive systems. Communicating the status of the system or problems with the system to the users is extremely difficult and when the system is down, all users are down. Access to, and security of, the data base is more difficult to control. Perhaps due to the remoteness of their access, users often perceive that their priority in the use of the system is at the bottom of the scale. There are also limits to the amount of customizing that can be accomplished to support the unique requirements of each base. Control of computer resources would not be closely aligned with the ITS management organization at each base.

b. ITS Network Configuration Alternative B - Distributed Mini-Computer System. This alternative, as depicted in Figure B-3, would interface via telecommunications lines a series of mini-computers located at each Air Force base to a small-scale computer system (or mini-computer) acting as a central repository "hub" for historical training data bases, and as a clearing house for inter-base transfers of ITS records and interfaces with other systems. Each base-level ITS system would have a complete set of ITS records and files pertaining to its AFSCs and personnel. All processing of individual task proficiency training requirements and updating of ITS files would occur on the base-level system. Data required at the central repository would be forwarded in batches on a daily basis. The MAJCOMs and HQ USAF would have direct link to the central repository of ITS data via telecommunication lines and would have access to software designed to analyze data and produce the evaluation reports of the system.

Since most of the computer resources for this alternative would be distributed at the base level, it would eliminate the need for an extensive data communications network for the critical day-to-day operational components of the ITS system. Computer downtime would affect only the small segment of users being supported by that system. The users would be more likely to view it as their system, and therefore, user acceptance would probably be greater. It would also permit a closer alignment of ITS computer resources with the ITS training management organization at each base.

Statistical analysis, simulation, and modeling capabilities would be minimal, as mini-computers typically do not possess the processing power of large-scale systems. Control and dissemination of software changes would be more difficult to accomplish. Once the data base for the central repository of historical data is designed, it would be much

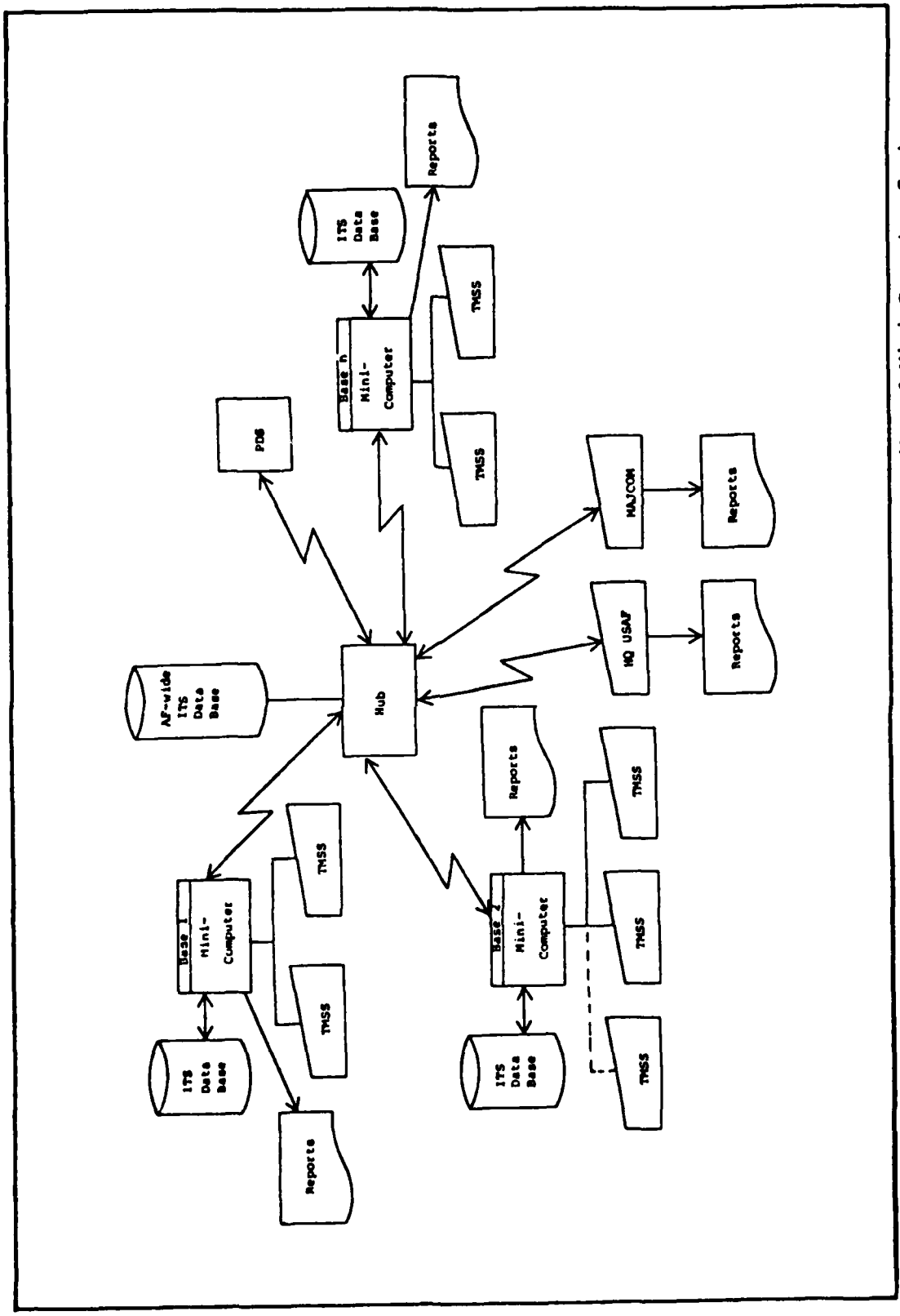


Figure B-3. Network Configuration Alternative B - Distributed Mini-Computer System

more difficult to adjust the format to reflect changing requirements at each base. This alternative would also result in a less efficient use of computer personnel resources and a probable requirement for additional computer personnel. The cost to process each transaction in a distributed system is typically higher than for a centralized system.

c. ITS Network Configuration Alternative C - Major Augmentation of Phase IV Base-Level System. This alternative, as depicted in Figure B-4, would provide the total base-level support for the requirements of ITS by augmenting the capacity of the planned Phase IV base-level system. The functions of ITS to be supported by the "hub" system would be provided by either the PDS computer system at AFMPC or a dedicated small-scale system installed at a designated site.

This alternative offers the same advantages as described for the distributed mini-computer (Alternative B), but in addition, would provide a direct interface and link with the PDS system. There are also potential cost savings in using the PDS software system in lieu of designing new software for maintenance of the airman training record and to satisfy the horizontal/vertical flow requirements of ITS. Since the Phase IV system would already be in place, personnel would be familiar with the computer equipment and terminals, and control of the additional computer resources required by ITS could be merged into the existing Air Force Data Processing Installation (DPI) organization.

This alternative offers the same disadvantages as described for the distributed mini-computer concept (Alternative B). Additionally, if the Phase IV system continues to use AUTODIN for the transfer of data, it could be considered a serious disadvantage in that use of AUTODIN is slow, cumbersome, and sometimes unreliable. The requirements of ITS could possibly exceed the capability/capacity of the Phase IV computer system at each base, thus necessitating another procurement for the base-level systems.

d. ITS Network Configuration Alternative D - Minor Augmentation of Phase IV Base-Level System. This alternative, as depicted in Figure B-5, would provide support for the requirements of ITS by removing the trainee management support functions from the Phase IV base-level system thus resulting in a significantly scaled-down augmentation of the base-level system. In addition, a network of micro-processors or mini-computers would be provided to support the trainee management functions of ITS at each base and these would be interfaced with the Phase IV system through a message processor or by multiplexing several units to a dedicated communications line on each base.

This alternative offers the same advantages outlined in Alternatives B and C. In addition, this alternative probably eliminates the possibility of exceeding the capability/capacity of the Phase IV computer system cited as a potential disadvantage in Alternative C. With that exception, this alternative offers the same disadvantages outlined in Alternatives B and C.

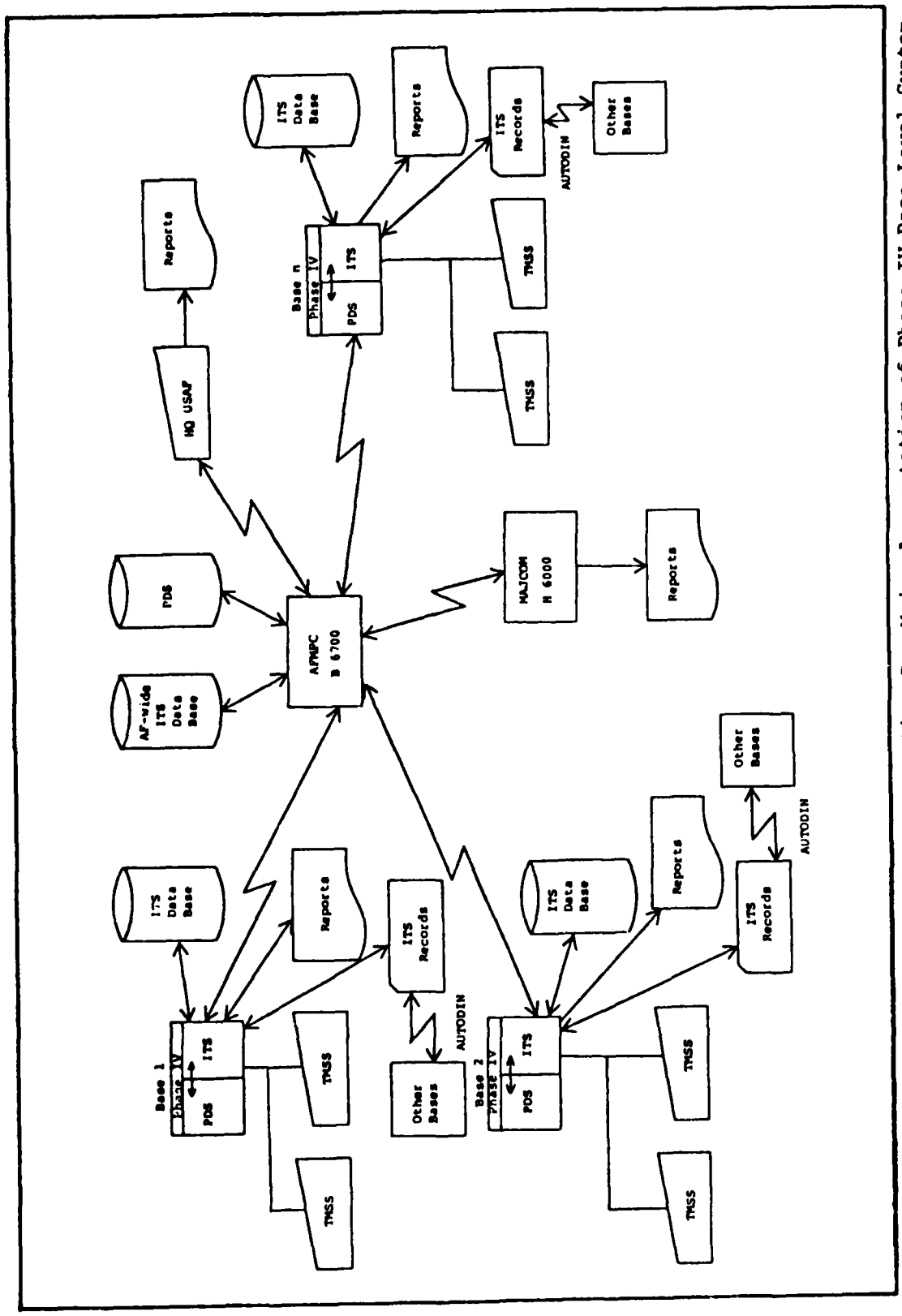


Figure B-4. Network Configuration Alternative C - Major Augmentation of Phase IV Base Level System

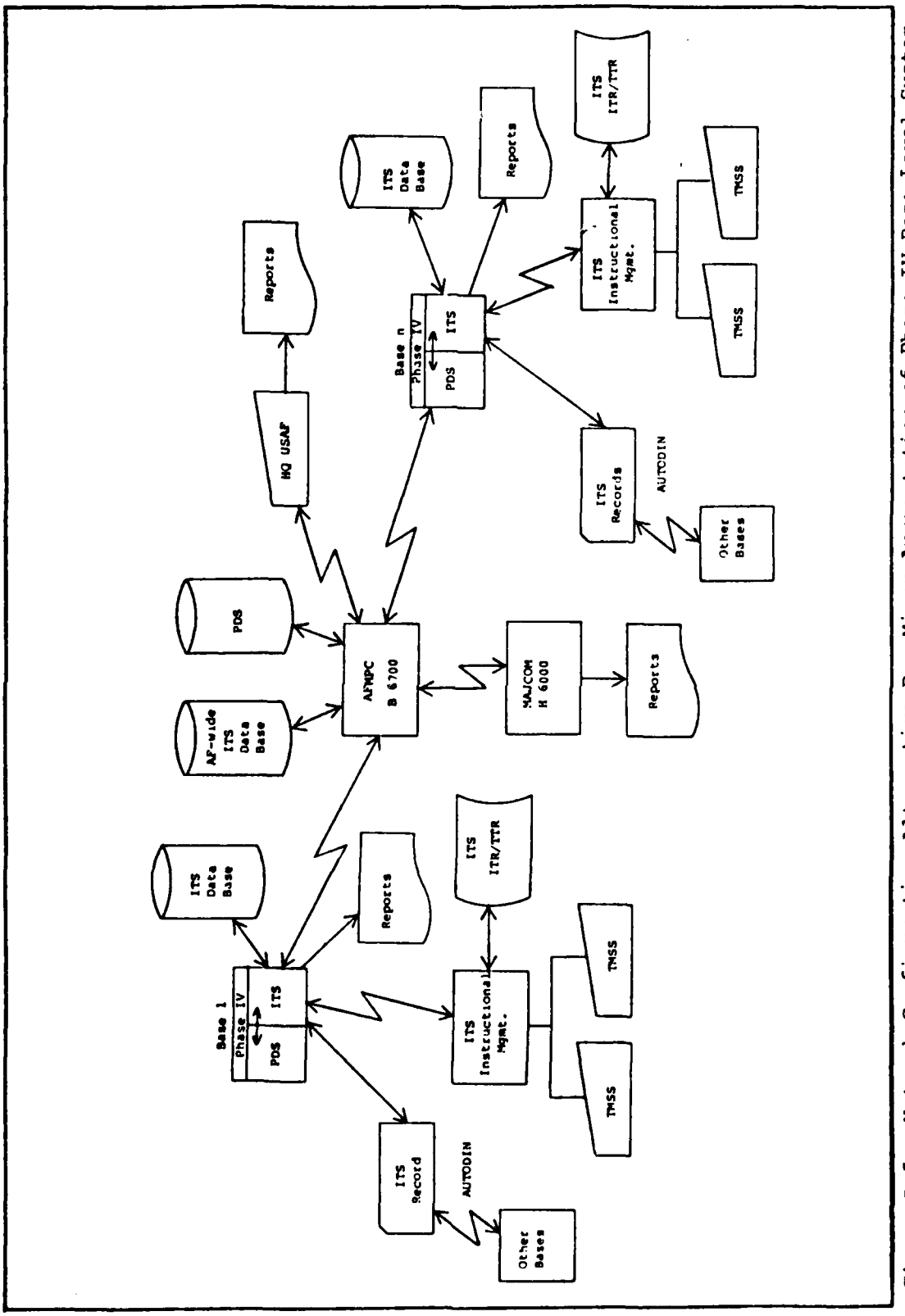


Figure B-5. Network Configuration Alternative D - Minor Augmentation of Phase IV Base Level System

ITS Trainee Management Support Alternatives. When the system requirements in Table 4 were examined in depth, the trainee management functions identified in the instructional management category were seen to be critical to the success of the system and to represent a most significant improvement over those of the current OJT program. Most of the instructional management requirements identified in Table 4 have been reflected in a general procedure flowchart in Figure B-6 that depicts the major steps required in managing the training of a typical trainee in a work center. These steps are distributed across the following training processes: the OJT orientation and diagnosis of training process, the job task training management process, the task proficiency training management process, and the quality control task evaluation process. Figure B-6 is intended to illustrate a general outline for the OJT trainee management process; it is not all-inclusive and should not be used in lieu of the requirements outlined in Table 4.

The quantity and currency of training-related data that will be collected from the trainee, trainer and supervisor at various points in the task training process, coupled with the input frequency required by the management controls specified for task proficiency training will necessitate that a cost-effective, interactive means be provided for data entry. Several state-of-the-art possibilities currently exist which could satisfy the trainee management data collection requirements of the ITS with varying levels of human effort involved. Each of the electronic alternatives was considered plug-to-plug compatible with most computer systems and could be compared independently of the basic computer system supporting the ITS. Because of this, the Air Force could select more than one type of "trainee management support system" if required to achieve the maximum degree of flexibility in supporting various operational requirements within work centers/sections.

The following alternatives were considered to be conceptually feasible options for the ITS in support of job task proficiency training. Each alternative provides a means to record the action accomplished, the trainee affected, the trainer performing the action, supervisor decision actions, and any other task proficiency training data required for operation of the system.

a. ITS Trainee Management Support System Alternative A - Portable Data Terminal Using Bar Codes and/or Optical Character Reader (OCR) Format. This method would use an optical scanning wand connected to a portable (hand-held) data terminal. Plastic tabs or stick-on labels would be produced for each action, individual, and task in the work center/section. These would then be inserted on a large board or on job performance training aids in the work area for use by all concerned. The required data would be entered into the portable device by passing the wand over the applicable bar code in the sequence specified for that action.

The portable data terminal would then be connected to a data communication line at specified times or randomly throughout the day to

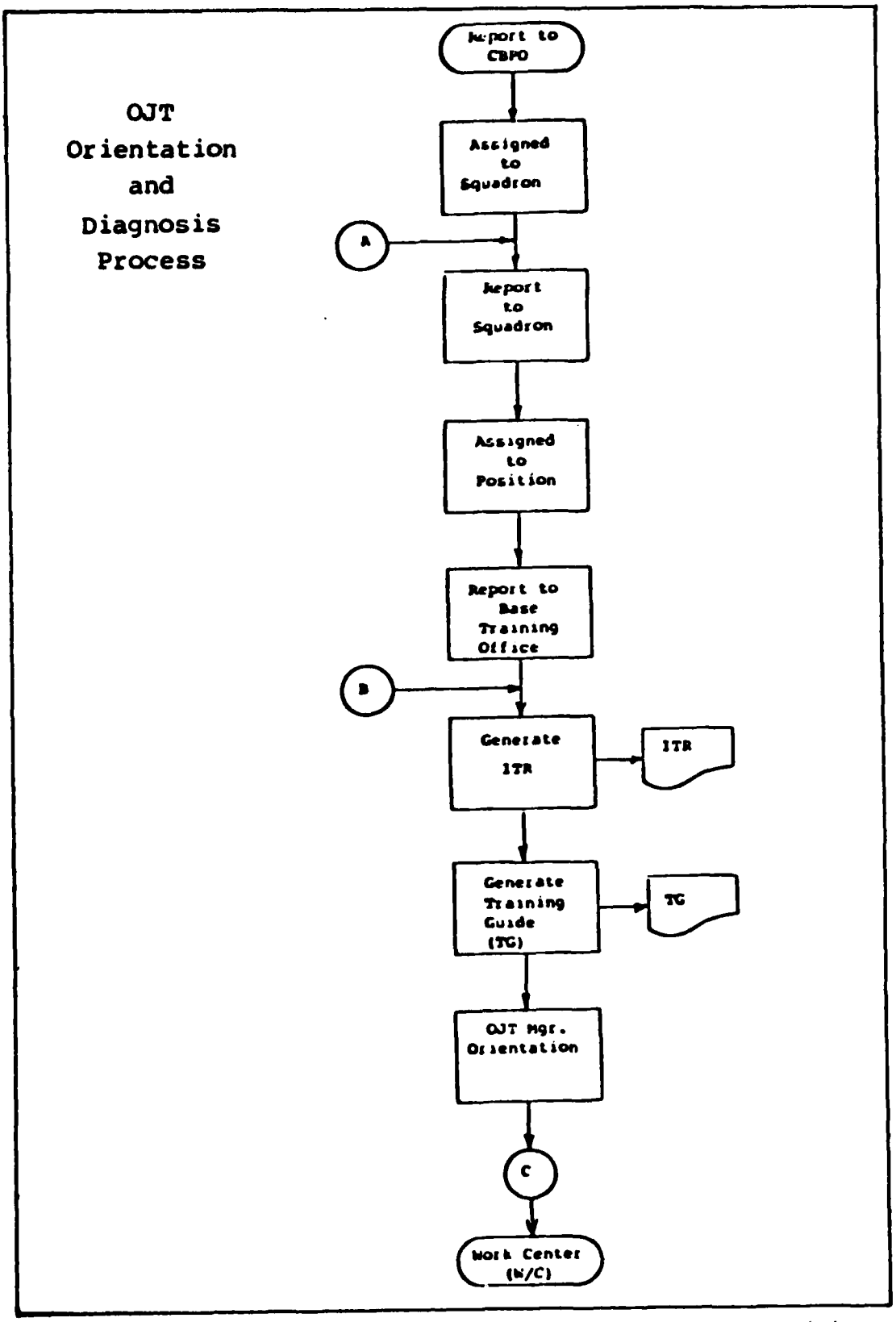


Figure B-6. Procedures for Management of Task Proficiency Training

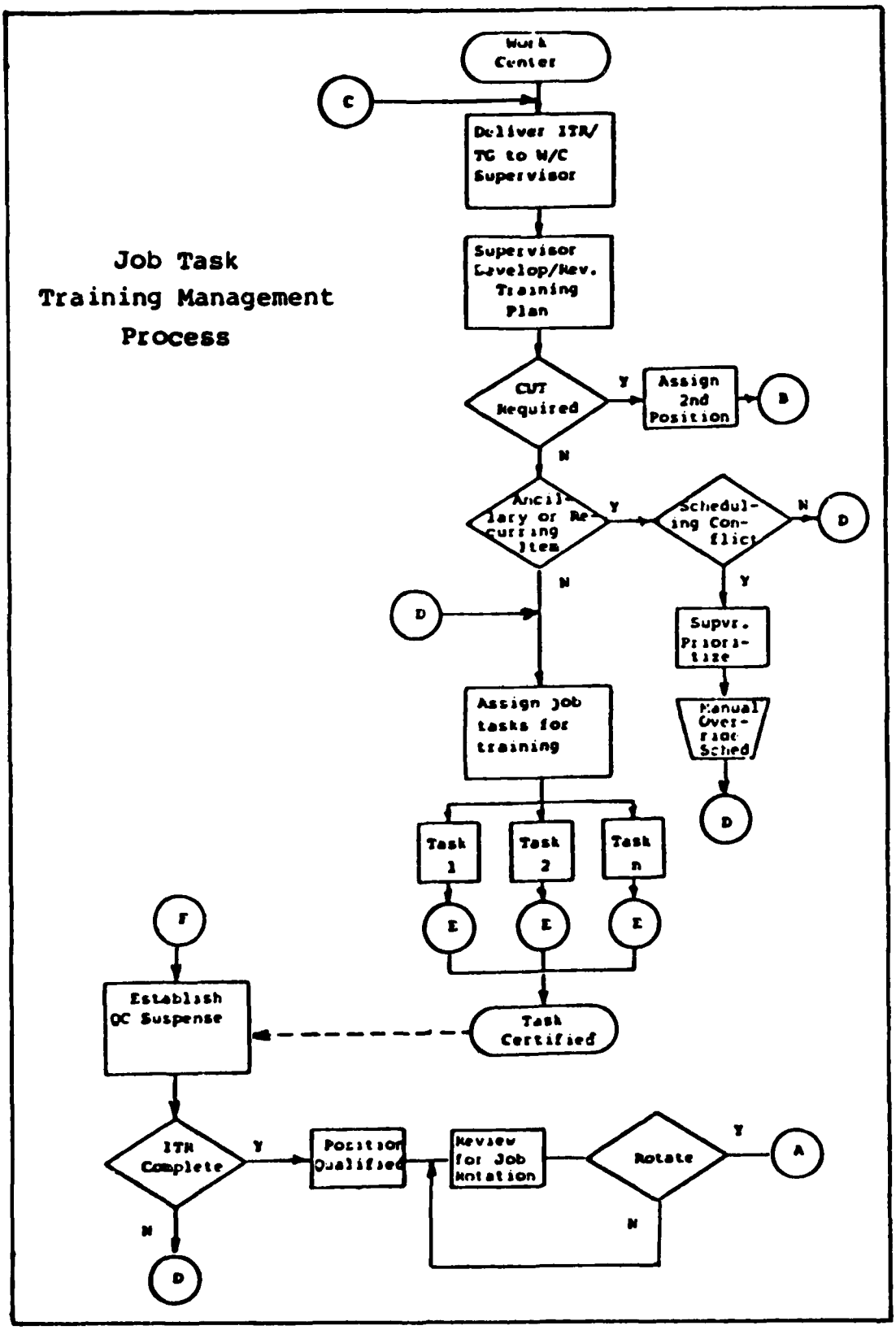


Figure B-6. Procedures for Management of Task Proficiency Training (Cont'd)

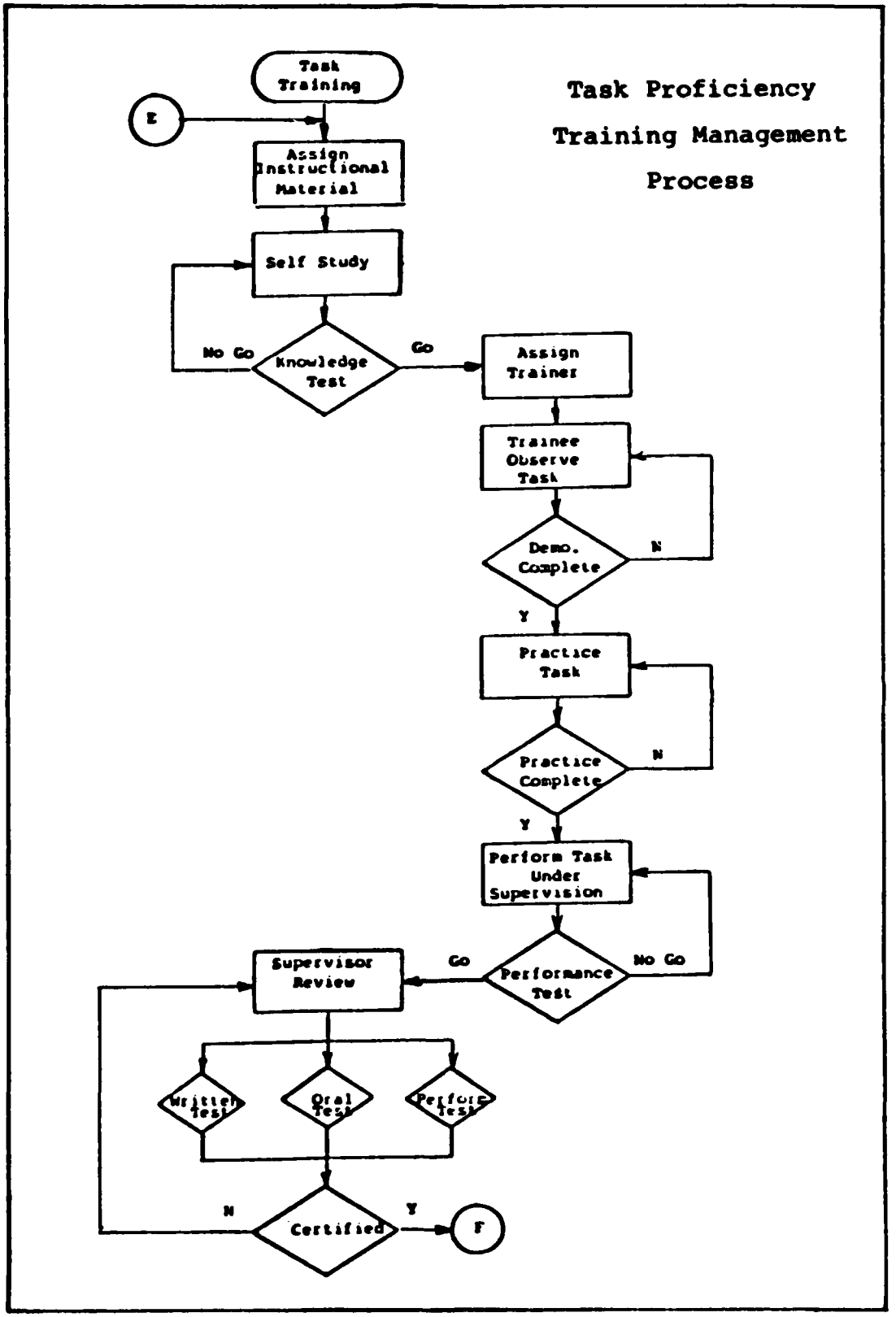


Figure B-6. Procedures for Management of Task Proficiency Training (Cont'd)

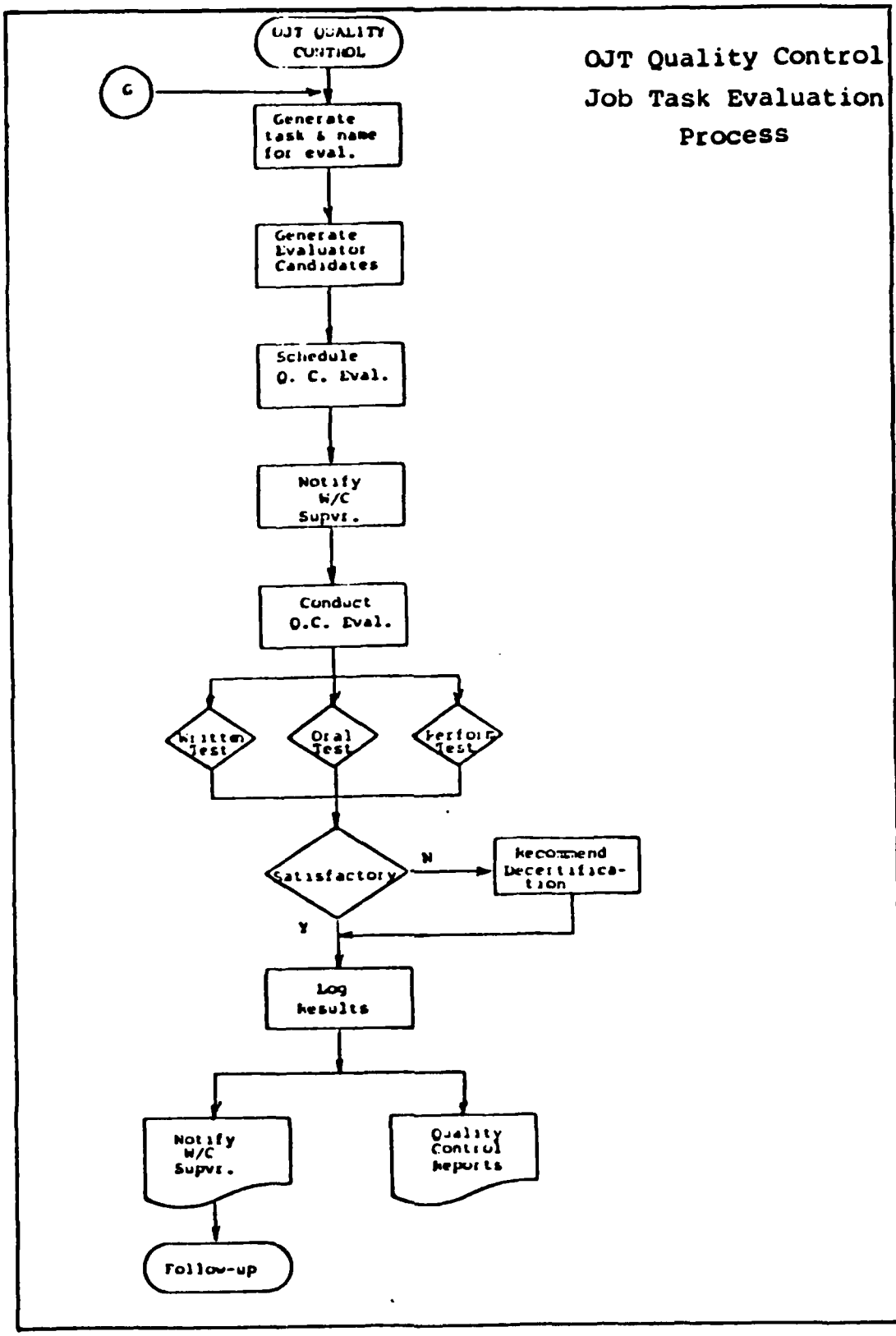


Figure B-6. Procedures for Management of Task Proficiency Training (Cont'd)

transmit the data collected to the computer system for updating the individual training record.

b. ITS Trainee Management Support System Alternative B - Magnetic Card Concept. This method would employ magnetic cards similar to those used by banking teller machines or the Washington, D.C., Metro transit system.

1. Option #1. As soon as the diagnosis of training requirements process is completed, a magnetic card containing the trainer ID, task number, task training steps, and other data would be generated for each job task to be trained. This set of cards would be stored in a pigeonhole designated for the trainee. Similar cards would be available to identify trainers and supervisors if required by the action being recorded. At each data point in the training process for a job task, the appropriate card would be removed from the pigeonhole and inserted into a reader device that is connected to a micro-processor or computer. Function keys would be pressed to indicate the action being recorded, the magnetic card itself would be updated, and a record of the action would be forwarded by the micro-processor to the computer for updating the individual training record.

2. Option #2. This method is similar to Option 1 except that the U.S. Armed Forces ID card would be used to enter ID data and the job task training procedural data would be prerecorded on a job performance training aid. At each data point in the training process for a job task, the ID card(s) and the job performance training aid would be inserted in a reader device. Function keys would be pressed to indicate the action being recorded and the appropriate data would be forwarded by the micro-processor to the computer for updating the individual training record.

3. Option #3. This option is the same as Option 2 except that a prerecorded magnetic card would be used in lieu of the job performance training aid for identification of the task training requirements and to monitor the correct sequence of steps in the training process.

c. ITS Trainee Management Support System Alternative C - CRT Concept. This method would utilize a cathode ray tube (CRT) with a keyboard and a direct interface with the computer to enter data into the system. A series of screens in menu format would be utilized to guide the user through a complete transaction. All data would be keyed into the CRT device either through direct keying or by bulk selection via the menu process.

1. Option #1. This method could be expanded to support the task knowledge testing process as well as the delivery of selected instructional materials in a CAI mode.

2. Option #2. This method could be combined with the magnetic card concept described previously to replace/augment many of the menu format screens.

3. Option #3. This method could be combined with the portable data terminal concept described previously to facilitate the data entry requirements and allow data collection at the training/work location.

4. Option #4. The direct interface with the computer could be replaced by using a small stand-alone system in which the ITS and data updates would be passed via diskettes through the base messenger service.

5. Option #5. This method would utilize a touch-panel display device such as the plasma terminal or an optical light pen option on a CRT to allow the user to touch the screen for identifying data to be recorded in lieu of keying in data to be recorded.

d. ITS Trainee Management Support System Alternative D - Point-of-Sale (POS) Keyboard Concept. This method would utilize the point-of-sale-type or POS-type devices that are now common in cafeterias, fast food franchises, and other retail locations. A point-of-sale keyboard consisting of 150 to 200 keys would be coded or designated with descriptive statements indicating the function of each key. Under this concept, a key would be reserved for each person in the work center and for each job task performed in the work center. Some keys could also be reserved for special functions such as action codes and numeric data. This device could also be equipped with a small printer to print an abbreviated record of the transaction as well as some information for the trainer and/or trainee.

At each step in the training process, a designated person would press the action code key. The device would provide prompts through a sequence of steps in which the keys identifying the trainee, task, and trainer were pressed. When the data entry was complete, the data collected would be transmitted by the POS device to the computer for updating the individual training record.

e. ITS Trainee Management Support System Alternative E - Audio Input Concept. This method would utilize a device designed to convert the spoken word of the human voice into electronic digital representation so that it can be recorded/processed in a computer system. The current technology of audio input devices is such that portable micro-recorders could be taken to the work area when training is being accomplished and the trainer could indicate each action accomplished, by making simple oral statements. At a convenient time, the micro-recorder would be attached to the audio input device and the statements would be converted and transmitted to the computer system for updating the individual training record.

f. ITS Trainee Management Support System Alternative F - Coding Form Concept. This method would utilize coding forms designed to enter all of the data required for each action. These forms would be collected daily and read by an optical scanning machine linked to the computer or forwarded to a data entry office which would convert the coded data into a machine-readable form. Recent technological

advancements in the microform field would allow a microform output option to be combined with coded input to eliminate any direct requirement for computer support in the work center/section.

Cost Analysis of ITS Computer Support Requirements

The computer support requirements for ITS were categorized into three different levels for comparative purposes. Processing requirements were defined for Air Force-wide functions, base-level functions, and trainee management support functions; each of these was considered to be independent of the other in terms of design options and projected costs for the system. Costs estimated in all alternatives were developed by averaging data obtained from industry and Government sources.

ITS Trainee Management Support System (TMSS) Alternatives Cost Analysis. The objective of this section is to analyze the alternative options available for computer equipment designed for directly supporting the task training process at the work center level. Each of the TMSS alternatives described in the previous section was analyzed for technical feasibility with the ITS design alternatives presented elsewhere in this report. The feasibility of each TMSS alternative is indicated in Table B-1, with a "No" indicating that either the ITS alternative does not support the requirement for use of that TMSS alternative or that the TMSS alternative is not a feasible approach to the requirement.

TABLE B-1. FEASIBILITY OF TMSS ALTERNATIVES

TMSS Alternative	ITS Alternative 1	2	3
A. CRT/Portable Data Terminal	No	No	Yes
B. CRT/Magnetic Card	No	No	Yes
C. CRT/Printer	Yes	Yes	Yes
D. CRT/Point of Sale	No	Yes	Yes
E. Audio Input	*	*	*
F. Coding Form	Yes	No	No

* Technology promising but not considered in cost analysis due to limited availability of data.

In each of the TMSS alternatives, it was envisioned that a variety of computer equipment devices would be required to provide an effective and functional environment for the ITS user. The projected basic equipment requirements to support a typical base for each TMSS alternative are provided in Table B-2.

TABLE B-2. PROJECTED TMSS EQUIPMENT REQUIREMENTS

Equipment	ITS Alternative						
	1	2		3			
	TMSS Alt. C	TMSS Alt. C	D	TMSS Alt. A	B	C	D
CRT	5	20	20	75	75	75	20
Printer	5	20		75		75	20
Optical Scanner		20	20				
Portable Data Entry Device				75			
Magnetic Card System					75		
Point of Sale			20				75

Cost data were developed for the options identified in Table B-1 and B-2 that were determined to be feasible in satisfying the requirements for each alternative configuration for ITS. The number of ITS support stations for each ITS alternative is specified in Table B-3. An ITS support station was defined as a location where automated computer support related to trainee management must be provided for data collection/report generation in direct support of a trainee, trainer, or supervisor. The cost of each TMSS option and the selected option for the cost analysis of each ITS alternative are provided in Table B-3. It should be noted that the decision to eliminate or discard any one of these options based on cost alone would not be appropriate until the potential benefits of each are explored in a demonstration under a variety of job-site training conditions.

TABLE B-3. COST ANALYSIS OF TMSS ALTERNATIVES
($ per Typical Base)

TMSS Alternative	ITS Alternative 1	ITS Alternative 2	ITS Alternative 3
Number of Base-Level ITS Support Stations	5	20	75
A. CRT/Portable Data Terminal	---	---	397,305
B. CRT/Magnetic Card	---	---	892,160
C. CRT/Printer	38,470*	452,984*	337,305*
D. CRT/Point of Sale	---	484,244	418,758
E. Audio Input	---	---	---
F. Coding Form	**	---	---

* Selected alternative for ITS Trade Studies Analysis
** Combined with ITS Alternative 1, Option C, for the cost analysis

ITS Base-Level/Air Force-Wide Computer Support System Cost Analysis. The objective of this section is to provide an analysis of the computer hardware options available for linking/interfacing the training environment and each TMSS with the computer providing support for the processing/reporting functions of ITS. The degree of computer support that would be provided at the base level is totally dependent on the major processing functions to be performed in relation to the network configuration alternative selected. In system design Alternative 1, network configuration alternative D was not costed, as the processing requirements did not generate the need for an ITS minicomputer. In system design Alternative 3, network configuration alternative C was determined to be not operationally feasible, due to the projected workload requirements of OJT.

Table B-4 contains a summary of the discounted life cycle costs of computer support options for the three levels of ITS support required for each ITS design alternative. These cost figures include estimates of the computer equipment costs, network telecommunications costs, and computer support personnel costs for each of the network configuration alternatives for both the base-level support required and for the Air Force-wide support of OJT. Detailed cost data associated with the options identified by an asterisk (*) in Table B-4 were utilized to compute the total estimated cost of each ITS design alternative.

TABLE B-4. COST ANALYSIS OF ITS COMPUTER SUPPORT SYSTEMS
(10-year discounted life cycle costs)
(in millions)

Network Configuration Alternative	ITS Alternative 1	2	3
A. ITS Central System	41.74	107.04	164.57
B. ITS Distributed System	143.86	205.12	387.57
C. AF Phase IV System	20.27*	96.10*	---
D. AF Phase IV/ITS Mini	---	105.20	117.12*

* Selected alternative for ITS Trade Studies Analysis

Demonstration Considerations. The development and demonstration phase of the ITS presents some interesting considerations with regard to the computer hardware requirements to support the effort. An analysis was also performed during the ITS computer trade studies analysis to determine the feasibility of using the CYBER 73-16 computer facility at Lowry AFB to support the demonstration, as opposed to the system identified to satisfy the requirements of the ITS preferred alternative. An analysis of this ITS development approach is provided in Table B-5, with the conclusion that the advantages of using the CYBER 73-16 for the development and demonstration of ITS would outweigh the disadvantages as long as adequate controls can be established on software development to minimize the reprogramming and transition costs incident to later full-scale implementation.

TABLE B-5. ITS DEVELOPMENT/DEMONSTRATION CONSIDERATIONS
COMPARISON OF CYBER 73-16 VS PHASE IV/ITS MINI

	CYBER 73-16	ITS Alternative 3 Phase IV/ITS Mini
Performance		
Advantages	o Adequate for DDT&E o Available o Specialized device for DDT&E o Use of AIS for Instructional/Trainee Management functions o Could become repository for job task identification functions o Could become repository for training development functions	o Adequate for DDT&E o Will be more like operational system
Disadvantages	o Could require extensive redesign of software at implementation o Conversion of PDS software for ATR functions	o May take time to acquire approval o Possible disruption to other base-level users o Uncertainty of Phase IV delivery
Logistics		
Advantages	o Use of R&D Resources	o Compatible with PDS o Conversion problems minimized
Disadvantages	o Incompatible with PDS	o Planning and coordination with Phase IV management and base-level DPI
Cost		
Advantages	o Minimal cost	o Software development
Disadvantages	o Possible telecommunications cost to demonstration o Software conversion at implementation	o Cost of initial equipment

GLOSSARY OF TERMS

Air Force Specialty (AFS). A group of positions that require common qualifications. Each Air Force specialty has a title and is identified by a numeric code.

Air Force Specialty Code (AFSC). A combination of alpha and numeric characters used to identify an Air Force specialty.

Airman Training Record (ATR). A conceptual ITS data base that contains an historical account of all training completed by an airman throughout his/her Air Force career.

Base-Level Training Requirements (BLTR). A conceptual ITS data base that identifies those training requirements which airmen must complete that are not related to an Air Force Specialty.

Career Development Course Requirements (CDCR). A conceptual ITS data base that identifies requirements and controls for each career development course used within the Air Force to satisfy career knowledge prerequisites for award of an Air Force Specialty Code skill level.

Comprehensive Occupational Data Analysis Programs (CODAP). A set of computer programs used to automate, process, organize, and report occupational/task data.

Consolidated Base Training Office (CBTO). A conceptual agency for the ITS given the responsibility for scheduling, managing, and evaluating all training conducted at a base.

Course Training Standard (CTS). A course control document. It prescribes the qualitative requirements of a formal course in terms of tasks, knowledge, and proficiency levels (extent of training).

Generic Position Training Requirements (GPTR). A list of tasks, drawn from the master task list, representing a generic duty position within an Air Force specialty. Capable of being transformed into an operational PTR listing tasks actually performed in a specific duty position.

Individual Training Requirements (ITR). A conceptual ITS data base that identifies and provides status of specific job task training requirements for an airman in his/her assigned duty position. It is envisioned as an interim record which augments the airman training record to provide a complete training record of both the training in progress and training completed for the airman.

Instructional Management/Delivery Control (IMDC). A conceptual ITS data base that provides the linkage to the instructional management and delivery specifications established for the task in the MIMDC. It would be utilized to direct and control learning activities of airmen and provide management information to their supervisors and trainers during the training process.

Instructional System Development (ISD). The five-step, systematic approach for developing instructional systems.

Integrated Training System (ITS). A computer-based system for the development, management, and quality control of Air Force OJT.

ITS Support Station. A location where automated computer support related to trainee management must be provided for data collection/report generation in direct support of a trainee, trainer, or supervisor in the OJT process.

Job Proficiency Guide (JPG). A document containing Air Force Specialty Code-related task descriptions used by Air Force supervisors as a guide for conducting training at a job site (now JQS, Job Qualification Standard).

Maintenance Management Information and Control System (MMICS). The automated system used within the Air Force logistics functions to manage and control maintenance-related data. Discussions in this paper reference the training subsystem of the MMICS.

Master Instructional Management/Delivery Control (MIMDC). A conceptual ITS data base that will contain standardized detailed descriptions of steps in the training process for task proficiency objectives. It would include the controls needed for proper sequencing of training and collection of data needed to measure trainee progress and provide management information. This data base would be available throughout the Air Force for use by units where identical tasks are trained.

Master Task List (MTL). A conceptual ITS data base that will contain all job tasks for each specialty within the Air Force. It would be used to standardize the identification and description of all tasks to provide for universal use throughout the Air Force.

Master Task Training Requirements (MTTR). A conceptual ITS data base that will contain detailed descriptions of job tasks for AFSs, the status and progress of development of all instructional materials and related documents, controls, and tools for building the MIMDC data base, and a catalog of all instructional materials related to training of tasks.

Occupational Survey (OS). The Air Force procedure for the identification of the duties and tasks which comprise one or more shredouts, prefixes, specialties, career field ladders, or utilization fields; and for the collection, collation, and analysis of information concerning such duties and tasks.

Operational Position Training Requirements (OPTR). A version of an ITS generic PTR that has been operationalized by the work center supervisor.

Personnel Data System (PDS). The automated system used within the Air Force for personnel management at the base and Headquarters Air Force levels.

Position - Standard AFR 35-1 definition: The duties and tasks that make up the job or work requirement for one individual.

- ITS definition: That group of duties and tasks assigned to an individual airman on a continuing basis. Positions would be operationalized within ITS through the OPTR and be identified by a "position number" and/or a "position title." There may be more than one individual assigned to the same position number, but if one individual has even one duty or responsibility that is different from the others, that individual should be assigned a different position number/title which defines the additional/ different duties and responsibilities. This definition does not preclude a supervisor assigning additional duties/responsibilities to a position on a temporary basis to compensate for an unexpected manpower shortage caused by such factors as emergency leave, illness, delays in personnel reporting to the unit, etc. However, if the individual is performing the additional duties on a continuing basis, the position should be redefined. In short, any change which occurs in the duties/responsibilities performed by an individual on a continuing basis should be accompanied by a change in that individual's position.

Position Training Requirements (PTR). A conceptual ITS data base that identifies all positions in a work center and each task applicable to each position. It would be used as a basis for identifying position and individual training requirements.

Qualification Training. Actual "hands-on" task performance training designed to qualify an airman in a specific duty position. This portion of the dual-channel OJT program occurs both during and after the upgrade training process. It is designed to provide the performance skills required to do the job.

Quality Control (QC). A conceptual ITS data base that contains a record of each job task and the identification of each airman for whom certification to perform the task has been completed.

Specialty Training Standard (STS). A training control document used in the standardization and quality control of airman training: identifies general study references and contains a specification of subject knowledge levels, task knowledge levels, and task performance levels required for each skill level in a specific AFSC.

Task Proficiency Objective. A specific statement of each task to be performed (including standards of performance) in each authorized position in the organization within which OJT is being provided.

Trainee Management Support System (TMSS). The computer hardware and communications equipment at an ITS support station used to enable trainees, trainers, and supervisors to interact with the ITS during the task training process.

Training Guide (TG). A plan used in the conduct of training.

Training Resources (TR). A conceptual ITS data base that contains a detailed account of the resources required to conduct job qualification training for every position on a base and those required to provide non-job-related training.

Unit Performance Summary (UPS). A conceptual ITS data base that provides a summary of the task certifications that have occurred and all training events completed within a given work center during specified time intervals. This would provide the basis for analyzing training effectiveness in relation to mission priorities.

Upgrade Training (UGT). That training airmen must receive to qualify for award of an AFSC skill level.

LIST OF ABBREVIATIONS AND ACRONYMS

AF	Air Force
AFB	Air Force Base
AFHRL	Air Force Human Resources Laboratory
AFMPC	Air Force Manpower and Personnel Center
AFR	Air Force Regulation
AFRES	Air Force Reserve
AFS	Air Force Specialty
AFSC	Air Force Specialty Code
AIS	Advanced Instructional System
ANG	Air National Guard
APDS	Advanced Personnel Data System
APR	Airman Performance Report
ARF	Air Reserve Forces
ASVAB	Armed Services Vocational Aptitude Battery
ATC	Air Training Command
ATR	Airman Training Record
AUTODIN	Automated Digital Information Network
BLTR	Base Level Training Requirements
BMT	Basic Military Training
CAI	Computer Assisted Instruction
CBPO	Consolidated Base Personnel Office
CBTO	Consolidated Base Training Office
CDC	Career Development Course
CDCR	Career Development Course Requirements
CE	Civil Engineering
CE	Course Examination
CODAP	Comprehensive Occupational Data Analysis Programs
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CTS	Course Training Standard
DDT&E	Design, Development, Test, and Evaluation
DPI	Data Processing Installation
ECI	Extension Course Institute
ESBI	Educational Subject Block Index
FAA	Federal Aviation Administration
FTD	Field Training Detachment
GPTR	Generic Position Training Requirements
HAF	Headquarters Air Force
HQ	Headquarters

ID	Identification
IG	Inspector General
IMD	Instructional Management/Delivery
IMDC	Instructional Management/Delivery Control
ISD	Instructional System Development
ITR	Individual Training Requirements
ITS	Integrated Training System
JPG	Job Proficiency Guide (now JQS, Job Qualification Standard)
JPTT	Job Position Technical Training
LCOM	Logistics Composite Model
MAC	Military Airlift Command
MAJCOM	Major Command
MET	Management Engineering Team
MIMDC	Master Instructional Management/Delivery Control
MMICS	Maintenance Management Information and Control System
MSEP	Maintenance Standards Evaluation Program
MTL	Master Task List
MTTR	Master Task Training Requirements
NCO	Noncommissioned Officer
NCOIC	Noncommissioned Officer in Charge
OCR	Optical Character Reader
OJT	On-the-Job Training
OMC	Occupational Measurement Center
OPR	Office of Primary Responsibility
OPTR	Operational Position Training Requirements
OS	Occupational Survey
PDS	Personnel Data System
PMEL	Precision Measuring Equipment Laboratory
POS	Point of Sale
PTR	Position Training Requirement
QC	Quality Control
R&D	Research and Development
SAC	Strategic Air Command
SACR	Strategic Air Command Regulation
SEI	Special Experience Identifier
SKT	Specialty Knowledge Test
SME	Subject-Matter Expert
SOA	Separate Operating Agency
SSAN	Social Security Account Number
STS	Specialty Training Standard

TAC	Tactical Air Command
TG	Training Guide
TMSS	Trainee Management Support System
TO	Technical Order
TR	Training Resources
UDB	Unified Data Base
UGT	Upgrade Training
UPS	Unit Performance Summary
VRE	Volume Review Exercise
WARSKIL	Wartime Skill Program
W/C	Work Center